OCT 2 2 1923

Devoted to Civil Engineering and Contracting. McGraw-Hill Company, Inc.

October 18, 1923

Engineering News-Record

In this issue:

Pollution of Water Supplies by Coal Mine Drainage

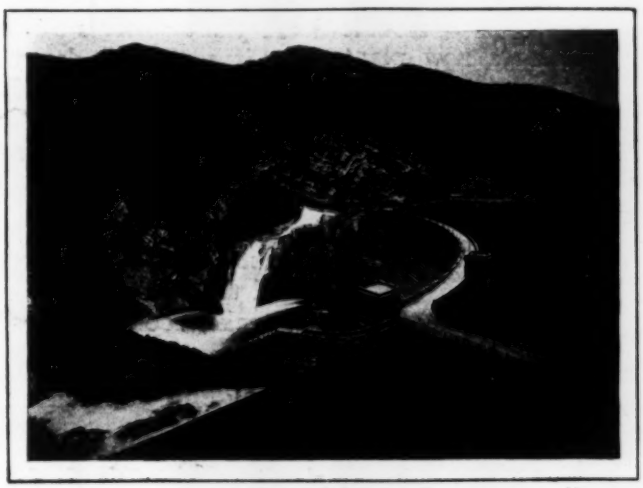
Surge Tank and Spillway on Pit River Plant

Design Features of Cold Storage Warehouse in Washington, D.C.

Railroad Bridge in Louisiana Built to Withstand Hurricanes

Reviews of Latest Engineering Literature

Next Week:



The series of articles on

FEDERAL RECLAMATION

begins in next week's issue with

"Origin, Problems and Achievements of Federal Land Reclamation

By F. H. Newell

the first chief engineer and the first director of the United States Reclamation Service

Also, in this issue

The third of the letters from the reclamation country by F. E. Schmitt, of the editorial staff of *Engineering News-Record*

A plant deserves a roof even better than its walls

Suppose the slim reward for the trouble and expense of erecting a new plant was the dismal prospect of rebuilding the foundation, floors, and walls after a few years!

—But of course that is not the outlook of the modern plant, and the chief reason for this is *concrete*—concrete walls, concrete foundations, concrete floors and walks.

Yet some builders that are using concrete for structural permanence are content with flimsy short-lived roofs.

A plant deserves a roof as permanent as its walls! It deserves a roof of precast stone-concrete of Federal quality —the roof that has been proved free of maintenance expense on America's best known industrial and public buildings.

Heat, cold, ice, steam, acid fumes and all the destructive forces that prey on weaker roofs leave Federal unharmed.

And its excellent appearance is rivaled only by its durability.

Federal Tile is made for all flat and pitched surfaces. To insure absolute uniformity and quality it is laid, and therefore guaranteed, by the manufacturer.

FEDERAL CEMENT TILE CO.
110 SO. DEARBORN ST., CHICAGO

FEDERAL Cement Tile

"The Roof for Permanence"

A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—JAMES H. McGRAW, *President*

ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, *Editor*
FRANK C. WIGHT, *Managing Editor*

Volume 91 — NEW YORK, OCTOBER 18, 1923 — Number 16

A Cabinet Officer Needs Educating

THE authoritative statement of Dr. Work's position in the Reclamation Service case, as set forth in our Washington correspondence this week, indicates that the Secretary of the Interior does not even now fully appreciate the significance of his action in removing an engineer from the head of an engineering bureau and placing there a so-called business man. He is still obsessed with the notion that engineering is merely the "building of dams and the digging of ditches" and that dam building and ditch digging can be carried on just as well under the superior direction of an unsuccessful banker as it can under a successful engineer. When he has had somewhat more experience with the intricacies of government irrigation—or possibly when he has received some instruction through the medium of a congressional investigation—he will know that reclamation is a continuing engineering problem, that requires for its supervision somewhat more than the acquaintance with human nature that presumably is the principal asset of the politician and business man, and which the Secretary assumes to be a nonexistent characteristic in an engineer. At any rate he is already learning that what he thought was merely a quiet little political maneuver has assumed proportions that threaten his whole administration.

Municipal Bond Market Overloaded

RECENT indications are that the market for municipal bonds is overloaded. A few weeks ago Detroit received no bids for a bond offering and more recently a fairly large offering by Dallas, Texas, brought no bids the authorities were willing to accept. For several months past higher interest rates have been necessary to secure bids favorable enough to relieve public authorities of worry over impaired credit standing. All this will have some bearing on the fate of bond issues up for approval at the November elections as well as upon the volume of construction work to be offered next year. By now, most of the items to be voted on in November have been fixed beyond change, but thinking voters will consider the bond market and it will also be taken into account by the public authorities in passing ordinances for later bond elections and in placing on the market bonds already authorized.

Convention Contrasts

THOSE who attend many society conventions in the course of a year marvel at the contrasts thus afforded. Most convention programs are overloaded with papers, a considerable percentage of which are not suited to reading and discussion on a convention floor. Too rarely a convention program is as well planned and carried out as was that of the American Public Health Association at Boston last week. Although—or was it because—the convention met in nine sections, besides the general meetings, there was plenty of free time for trips of inspection, and these were well organized. There was also time for discussion of the papers and reports, at least in the Sanitary Engineering Section. It was hinted, above, that sectional organization explains the well ordered character of the A. P. H. A. meeting. Doubtless that had much to do with it, but a little earlier the New England Water Works Association had a convention at Burlington which, with no section meetings, was also well ordered and afforded ample time for discussion. What many of our technical societies need is program planning of a kind that will keep the papers and reports so limited in number, and insure that they are of such a character, as to bring out full and free discussion—for as a rule a society paper not of the sort to elicit discussion should not find a place on a convention program.

Activating Superpower

HERBERT HOOVER, with characteristic directness and clarity of purpose, has taken the only initial step that will lead to the development of the so-called superpower scheme for the Eastern industrial zone. The engineering advantages and difficulties of this huge undertaking have been thoroughly analyzed and made public; there remains now the tremendous inertia of public and private action to be overcome. It is true, as the Secretary of Commerce says, that the federal government could step in to initiate the superpower work by direct action, but that is incompatible with either public policy or private needs. But the government is doing a much more useful work in bringing together the power interests and the state authorities in the Northeastern states to work together to develop plans whereby the numerous legal and statutory restrictions to interstate power transmission may be overcome. Once the public agencies can get together with some joint workable plan, the private interests and the state engineers can proceed along engineering lines to develop the technical requirements of joint production and transmission of power. The Department of Commerce can be trusted to continue to activate the study of superpower and in so doing will hasten the day when it becomes an actuality.

Special Privilege at Muscle Shoals

WHETHER or not the political prophets are right in saying that Henry Ford's first public statement on the Muscle Shoals proposition, noted in the news pages, is the opening gun in his presidential campaign is no concern of ours. We are concerned, however, with the unfair position the Detroit manufacturer takes toward the whole Muscle Shoals controversy. To read his statement one could well believe that an adequate and scientific offer for the government property on the Tennessee was being blocked by predatory political and

financial interests. This is not a fact. What Ford neglects to mention is that his offer is in contravention of the established water power law of the country and that the system of payment proposed is in contravention of any accepted law of economics. Mr. Ford is becoming more and more egocentric. It is perhaps natural that he should come to think he is a law unto himself, but he and his advocates must be made to understand that even his demonstrated efficiency in some lines does not place him in a privileged class before the law. If he is in earnest in his wish to make fertilizer and to distribute cheap power from Muscle Shoals (and this is the first time he has actually said that he would make commercial power) he should make a proposition which not only will adequately reimburse the government in accordance with law but will give more assurance of that intention than the mere spoken word of a man —a superman if you will, but one who can hardly transmit his human qualities by word of mouth to the corporation which will succeed him in a few years.

Winter-Work Records Wanted

LACK of data on winter operations is hampering the work of the agents of the Department of Commerce who are investigating seasonal construction. So few contractors in any community have kept close account that it is virtually impossible to formulate definite conclusions as to the percentage of workable weather and temperature effects on efficiency and costs in that community. These data are needed if we are going to arrive at any true findings concerning the remedies for seasonal work—for two reasons particularly: (1) Since winter construction is an economic problem, owners must be shown that it is profitable to build in cold weather, and (2) winter construction is a different problem in different temperature and storm areas. Very complete data of winter construction operations in Atlanta, Ga., if they should happen to exist, would obviously be of limited service to contractors in Cleveland, Ohio. There is apparently in the difficulties of the Department of Commerce agents an opportunity for associations of builders and general contractors to perform a needed service for the industry—the collection of winter construction data, each organization in its own community. All organizations functioning intelligently this winter would leave very few sections of the country unrepresented in the records of the Department of Commerce. There is a duty to be performed by contractors' associations in discovering the conditions of cold weather work and winter idleness.

Labor Difficulties Up to Building Public

THAT those who complain of labor ills in the building field have the remedy in their own hands has been demonstrated in Chicago for the past two years. While everybody in the building business has not supported the Citizens Committee to Enforce the Landis Award, enough did do so to keep down strife and permit a period of building during an unprecedented boom without interruption of any kind except the delays incident to an extraordinary over-demand for labor. In twenty months building permits have exceeded a half billion dollars and the rate now is about two and one-half times that of any previous period. Graft has gone. Union and open-shop men work side by side without smashing each other's heads. Labor leaders are said to be afraid to call strikes fearing a revolt of the men, although usually a boom period and labor scarcity is considered the heyday of the striking delegate with his arrogant orders to strike at the least provocation. The committee has brought 15,000 to 20,000 men into the city and placed more than 50,000 men through its employment offices.

Naturally, there have been sporadic cases of rioting, bombing and slugging; the committee members have been threatened but the criminal element has been about worn out. Two police have been killed but public sentiment forced the state's attorney to act. Special prosecutors were put to work; $100,000 made available and the volunteer services of prominent lawyers obtained. Twenty labor criminals are wearing prison stripes and several more are in jail, for which the decent laborer is as pleased as the bystanding public.

Apprentice schools have been started. Bricklaying, plumbing, sheet metal work, painting and carpentry can be learned without the onerous restrictions of the unions.

Recently certain contractors who have out-of-town all-union jobs have pulled away from the Landis Award committee and rumors to the effect that the committee was losing ground and would disband have been circulated. At a recent meeting of the Chicago Association of Commerce and a few days later of the contractors and architects the members of the committee, T. E. Donnelly, James A. Patten and John W. O'Leary, emphatically denied any thought of quitting, but they made it plain that the fight was not that of the contractors, nor of the committee, but of the building public. Active support from the public is essential. If the enthusiastic applause greeting this request is any criterion, the committee will stay on the job, and Chicago building will continue indefinitely unhampered by labor troubles.

How Shall We Gage Water-Supply Purity?

NOTHING could better illustrate what many people—wrongly, we think—deprecate as an insidious, rapid and far reaching usurpation by the federal government of powers rightly belonging to the state, than the strong control of the character of public water supplies which is being gained by the Treasury Department through the United States Public Health Service. Based, as are so many other kinds of federal control, on the interstate commerce clause of the Constitution, the Public Health Service put out some ten years ago a bacterial standard for water supplied for drinking purposes on railways and other interstate carriers. This standard it is now proposing to make more rigid and although it has no power to impress these requirements on municipalities the nature of the situation is such that the new regulations will have a potent effect on all public water supplies.

We question neither the power nor wisdom of the federal government in its interstate control nor the choice of the agency for the purpose, but we do urge caution in the methods employed in exercising the control lest there be a reaction against this and other instances of federal control and more particularly lest the Public Health Service, in attempting to promote the public health in one field—a field in which practice is far in advance of that in most other municipal fields—

cause a retardation of progress along other lines which would bring far greater returns for the same expenditure of money. The danger that we have in mind is one that is incident to all work along highly specialized lines unless there is constantly a broad vision of all the needs in collateral fields, or, in other words, a consideration of relative values.

Whether foreseen or not, the Public Health Service standards for drinking water are rapidly becoming the standards for all public water supplies; that is, they are being so considered more and more by sanitarians, state boards of health, the courts, the press and, gradually, the general public. The press and the general public, in particular, have little knowledge of the fact that the B. Coli standard now in use and proposed to be made still more rigid is merely a tentative index of pollution—much like the albuminoid ammonia, chlorine and total bacterial count standards that preceded it. Although this is thoroughly understood by the specialists, it does seem at times as though even they set up the B. Coli standard as a fetich, though there is as yet no certain way of telling whether the B. Coli found in water are of human or animal origin.

In view of such limiting conditions to the B. Coli index, great care should be taken against raising it unduly, since there is no certainty of getting health results commensurate with the possible heavy expense entailed to comply with the standard. This seems to be all the more important since, as we suggested at the outset, the municipal water supplies of the country as a whole seem to be far in advance of almost any other branch of the municipal service coming under the general head of sanitation and public health. If and where this is the case, should not the Public Health Service, and the state and local health services as well, be concerned first of all with the raising of other sanitary and public health services to the level already attained by the public water supply, rather than with forcing the water supply to a still higher level of quality, measurable merely by an index of pollution beset with much uncertainty?

In raising this question we fully understand that the regulation of the quality of water supplies on interstate railway trains and steamers must of necessity be conducted from the viewpoint of protecting passengers from all parts of this and other countries, rather than from the viewpoint of a given individual city. We also understand fully that the water supply of many cities, and perhaps of nearly all the cities of many states, is already well up to the present Public Health Service standard and perhaps has reached the level of the proposed standard or can be brought there quite readily. At the same time, it is evident, from the utterances of federal, state, and local officials engaged in the various conferences that have thus far been held over the proposed new standard, that a considerable number of water-works officials of the country, including those from a number of important cities, are deeply concerned as to the difficulties and expense involved in meeting the proposed new standard—in fact, have not met the old one—and that there is also considerable concern on the part of all the classes just mentioned as to whether the B. Coli standard alone should govern.

Although there has been considerable talk as to the advisability or possibility of giving large weight to a sanitary survey of each water supply, the present indication seems to be that for some time in the future at least, as has been the case in the past, many supplies will be judged chiefly from the bacterial standard. This is due in part to the comparative readiness with which bacterial analyses can be made and interpreted as compared with the sanitary survey. It should be noted that the Public Health Service has no facilities for conducting either bacterial analyses or a sanitary survey. It must rely almost wholly upon state and local supervision of water supplies, merely accepting these or else, in cases of material doubt, refusing certification on the strength of reports that come to it from state sanitary officers.

If there be uncertainty, as there certainly seems to be, as to the weight that is to be given in the future to the sanitary survey as compared with the B. Coli index, the uncertainty is still greater as to paying much if any attention to the typhoid and other statistics of a community that may be regarded as reflecting the character of the water supply. From the very narrow viewpoint of water supply alone this is natural enough, but from the broad viewpoint of public health, both of a given community and of the country as a whole, it seems very unfortunate. Inasmuch as the B. Coli index is an index only and an uncertain one at that so far as its real significance is concerned, why not give material weight to the vital statistics of a community, or that part of them known to be affected by the character of the public water supply, in certifying a water supply from a community, say like Providence, R. I., where during the whole year 1922 and so far in 1923 there was not a single death from typhoid fever? There are many other cities which are in the same general class as Providence so far as complying with either the old or the proposed new B. Coli index is concerned. Some of these communities, like Providence itself, are voluntarily taking steps that will lead within a few years to a water supply of a different and probably much improved character. In much the same way the trend in whole states is toward a materially higher standard of water supply than now exists.

What we urge is careful consideration of the possibility of establishing and administering a water standard along broad enough lines to guard against the possibility that a city may be forced to expend a relatively large sum for the compliance with an arbitrary tentative standard of water quality, with no certain evidence that any lives will be saved or sickness prevented thereby, when the required expenditure could be used for other purposes that would undoubtedly save more lives and prevent more sickness in the community in question. Such consideration should not, of course, go so far as to endanger any traveler on railway trains or steamboats who drinks water taken from that city, even though it be but once a year, but after all what is the better index of the safety or danger of a given water supply: a B. Coli content that may be due to causes that have nothing whatever to do with any disease to which human beings are liable or the vital statistics of the community constantly using the water supply?

We think a careful weighing of the elements that may properly enter into a standard for water supply, including the broader health considerations we have mentioned, will show conclusively that much weight should be given to the sanitary survey and to the vital statistics of a community in deciding whether or not its water supply is safe for use on interstate trains and steamers.

Rigolets Bridge Built to Stand Hurricanes: L. & N. R.R.

Each Pier a Concrete Cylinder Sunk 80 to 113 Ft. Below Sea Level on Gulf Coast—Steel Shells Sunk and Concreted—Truss Spans and Draw—Construction Equipment Floating or on Piles

BUILDING A BRIDGE in an exposed situation subject to tropical hurricanes and to heavy wave action is the unusually difficult condition to be met in the reconstruction of the Rigolets Bridge on the main line of the Louisville & Nashville R.R., about thirty miles east of New Orleans. This bridge crosses a tidal pass known as the Great Rigolets, connecting Lake Borgne and Lake Pontchartrain. The general situation is shown in Fig. 1.

Hurricane Conditions—For many miles on each side of this crossing the railroad traverses a salt marsh along the Gulf coast and is subject to violent hurricanes which at times have caused severe damage to the railroad and to the bridge. During storms of 1909 and 1915 several of the plate girder spans were carried

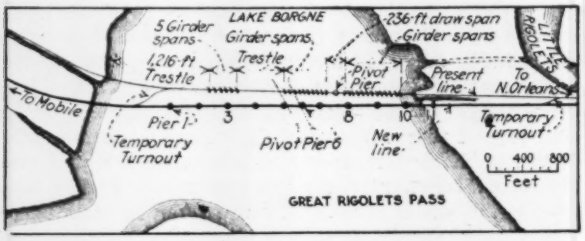


FIG. 1—RECONSTRUCTION OF RIGOLETS BRIDGE; L. & N. R.R.

away by the combined action of wind, waves and current. In violent storms the waves reach a height of about 10 ft. above mean sea level or 2 ft. above the bottom flanges of the present girders. The tidal range is only about 15 in.

Tropical hurricanes originating at the eastern end of the Caribbean Sea and blowing through the Gulf have a diameter of about 250 miles, with a velocity of translation of about 12 m.p.h. and a rotary velocity as high as 125 m.p.h., as determined from observations made south of New Orleans. It is this rotary velocity which does the damage. At the bridge the wind may blow in any direction, depending upon the position of the center of the storm in relation to the structure. In the pass the line of current makes an angle of about 64 deg. with the bridge. The highest current velocity determined by measurements is 4.2 miles an hour, when the water was about 4 ft. above normal level and the center of the storm was between Mobile and Pensacola. But the maximum velocity due to hurricanes has never been determined, since men cannot stay on the bridge during these storms and registering instruments could not be used under such conditions.

Old and New Structures—The present bridge at the Rigolets was reconstructed in 1902, but the storm of 1909 destroyed eight of the deck girder spans. A temporary timber trestle was built to close the gap, and in 1911 seven 60-ft. through girder spans were built in place of the original spans. The hurricane of 1915 destroyed sixteen of the girder spans, and these have never been replaced, since the railway company had intended to build an entirely new bridge when financial conditions permitted. For this reason temporary trestles in place of these sixteen spans have been maintained since the storm mentioned.

In its present state, therefore, the bridge consists mainly of two groups of steel girder spans on piers of creosoted piles, these groups being separated by a 560-ft. stretch of creosoted pile trestle with open deck. One group has five through girder spans of 59 ft. 8 in., and the other has twenty similar spans of 52 ft. 10 in. and a 236-ft. through-truss swing span. There is a navigable channel on only one side of the pivot pier. The base of rail is about 13 ft. above mean sea level. Creosoted pile trestles form the approaches. It will be noted by the plan, Fig. 1, that all the old steel spans are on the skew, the piers being arranged in line with the direction of the current. These pile piers are described farther on.

In the new bridge, Fig. 2, which is intended to be substantial enough to withstand any hurricane likely to occur on the Gulf coast, there will be eight through-truss riveted spans 330 ft. c. to c. of bearings, with a 414-ft. swing span. This gives a total length of 3,097 ft. c. to c. of end piers. Special provision will be made for anchoring the spans to resist the force of hurricanes. Ten concrete cylinder piers will support the spans, but the cylindrical pivot pier will be filled solid and the west end pier will be of the usual rectangular plan and supported on piles. By approach grades of 0.3 per cent at the west and 0.25 at the east end, the elevation is raised so that the height from mean sea level is 18 ft. to base of rail and 13 ft. 4½ in. to lowest point of steel.

Location and Approaches—In order to avoid interference with traffic during construction, the new bridge is located alongside but somewhat diverging from the present structure, being placed at a sufficient distance to be clear of all wreckage from the latter, which has been damaged several times by storms. The greatest distance between the structures is 200 ft. At the east end is a curve of 1 deg. 40 min.

Long timber trestles will form the approaches, as the marshes over which the line is located are too soft to sustain the roadbed. There will be 7,769 ft. of trestle at the east end and 3,435 ft. at the west end all with 12-ft. spacing of bents. Creosoted piles in six-pile bents are used for that portion of the trestle which will remain permanently, while green piles in four-pile bents are being used for the portion which will be filled for a solid embankment.

The greater part of the trestling will be filled, and owing to the soft ground it is expected that when this filling is completed there will be more material below the marsh level than above it. Since the placing and compacting of the fill will thus extend over considerable time, the trestles will be constructed of ample strength to carry trains for several years, thus allowing ample time for the embankment to settle and also providing for placing additional material as settlement occurs.

Substructure—Special interest centers in the design of the substructure, with piers sunk in loose material, standing in deep water and exposed to heavy storm waves (see Fig. 2). After careful consideration of these violent lateral forces it was decided to adopt piers

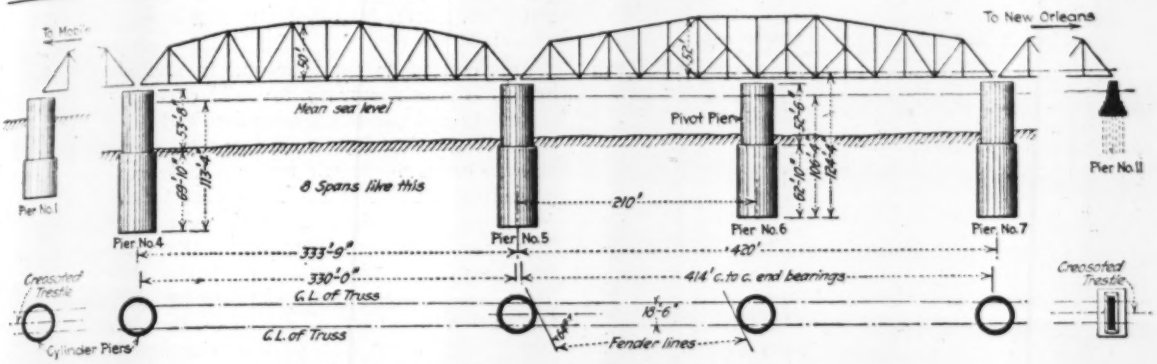


FIG. 2—TRUSS SPANS AND DRAW ON DEEP CYLINDER PIERS

of annular or cylindrical form, the design of which is shown in Fig. 3. In each pier the portion sunk below the bed of the Rigolets will be 34 ft. in outside diameter, while the upper part will be 28 ft. in diameter, the change in dimension being made by a square offset. In both portions the central well will be 16 ft. in diameter, giving a wall thickness of 6 and 9 ft. in the upper and lower portions respectively. This wall will be of reinforced concrete and a 6-ft. slab or cap will form the top of the pier to support the bridge seats.

For each pier a cylindrical steel shell or caisson will be sunk, having dimensions conforming to these above noted. Typical construction of these cylinders is shown in Fig. 4. The sinking will be done by open dredging, but arrangements have been made for capping the shell at any required height with a steel dome, so that the pneumatic process may be adopted if necessary to sink through logs or other obstructions. The annular space between the inner and outer shells will be filled with reinforced concrete as the piers are sunk. When the pier has reached the intended depth the bottom of the well will be filled with concrete to a depth sufficient to insure distribution of the load over the entire base area for the pier. For the pivot pier, however, this filling will be carried to the top of the cylinder and will be formed with a recess 13 ft. square and 18 in. deep to receive the steel grillage supporting the center stand of the swing-span turntable.

In the design of the piers no allowance was made for the steel shell, the reinforced-concrete cylinder being designed to have ample strength and stability in itself. It is expected that the piers will be sunk to depths of 78 to 113 ft. from mean sea level to the cutting edge, or 70 to 80 ft. below the bed, but the actual depths may be varied according to conditions encountered in sinking.

Foundation Conditions—The maximum depth of water below mean sea level at the site of the new bridge is about 45 ft., while under the present bridge it is about 57 ft. It is considered manifest that there has been some scour under the latter and it is the purpose to sink the new piers to such a depth as to be stable in spite of any probable amount of scour.

Borings made on the site of the new bridge do not show great uniformity, the material varying from soft black mud near the bed of the pass to stiff yellow clay, fine sand and some gravel. The mud is of considerable thickness under the shallow water near the shores, but there is very little of it in the deeper water. It is expected that the cylindrical piers will be founded either on stiff gray clay or hard packed sand. The formation of the bed of the pass and of the adjoining salt marshes has been built up evidently with silt from the Mississippi River at a time when this territory formed a part of the delta of the Mississippi.

Pier Construction—The bottom section of each double-shell steel cylinder, about 27 ft. 10 in. high above the cutting edge, will be built up on a dock and then floated to position, where part of a circular cofferdam of steel sheet piling will have been driven. The remainder of this piling will be driven after the shell is floated into position. The purpose of the cofferdam is to avoid the influence of current and to reduce the effect of scour. The cylinder will be sunk by interior dredging assisted by water jets, the shell being built up and concrete filling placed as the sinking proceeds.

Typical details of the steel shells are shown in Fig. 4. They will be of ¼- and ½-in. steel plating, with interior angle rings to which twenty-four radial braces are bolted. This bracing will be furnished for two piers only, being removed in advance of concreting and thus salvaged for the next piers. The conical shell for

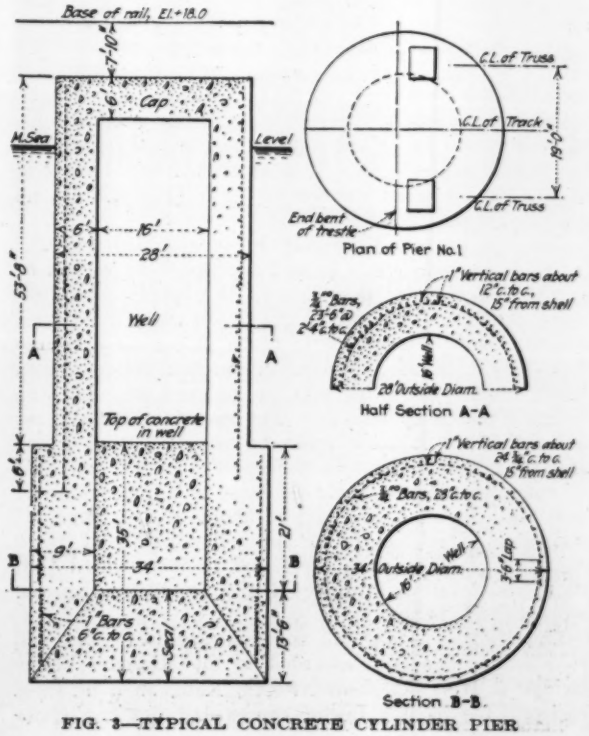


FIG. 3—TYPICAL CONCRETE CYLINDER PIER

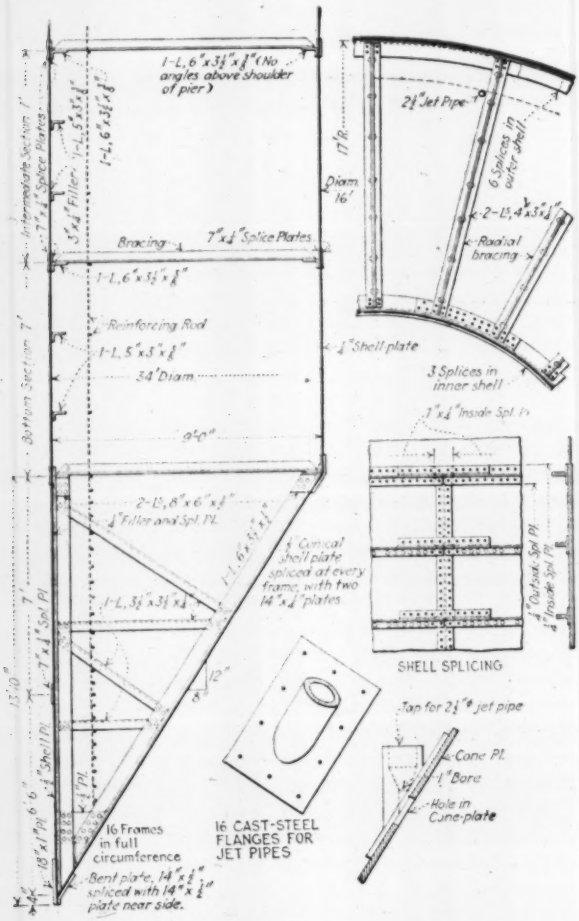


FIG. 4—STEEL SHELL FOR CONCRETE PIER

the cutting edge is braced by sixteen frames and has sixteen cast-steel flanges for 2½-in. jet pipes. Each bottom section, 13 ft. 10 in. high, will be set up complete in the shop and all other shell plating will be fitted to templets at the shop to insure accurate fit. All joints will be calked in the field to make the shell thoroughly watertight. This steelwork will have one shop coat of boiled linseed oil and there will be no field painting.

Concrete of 1:2:4 proportions is specified and will be made with gravel. It will be placed by means of buckets handled by derricks, as the specifications require a mix too dry for chuting. In sealing the well of each pier the concrete is to be placed by a tremie to a height of 13 ft. 10 in. above the cutting edge, after which the water will be pumped out and the concrete placed by buckets. The specifications also require that all laitance must be removed, that green and set concrete must be thoroughly bonded and that all concrete must be made as dense and impervious as possible. In all there will be about 26,700 cu.yd. of concrete. Steel reinforcement will consist of plain round bars of medium steel and it is provided that these must be well protected from moisture on the storage dock before use.

Construction Plant—A contract for the piers and foundations has been awarded to the Missouri Valley Bridge & Iron Co., Leavenworth, Kan., on a modified cost-plus-fee basis. Docks, camps and floating equipment have been provided but actual construction has been held up by delay in getting steel delivery.

As there is no solid ground in the vicinity of the bridge it was necessary to build docks for storage of materials and for camp buildings and other temporary structures. Fig. 5 shows the general plant layout. The railway company built a spur track from the main line extending about 300 ft. into water 10 or 12 ft. deep. Docks for the various materials were built adjacent to this spur in water where the depth was sufficient to load barges and operate a tug. Materials are unloaded from cars on the spur onto the storage docks and transferred thence to barges. Docks for the steel and cement house are on one side of the spur and those for the sand and gravel storage piles on the other side. Views of the plant are shown in Fig. 6.

All these docks are on piles 50 to 60 ft. long, driven about 6 ft. c. to c. The steel dock is 40x60 ft.; the covered cement dock, 24x96 ft.; sand dock, 40x50 ft., and the gravel dock 70x50 ft. Camp buildings, tool houses, office, blacksmith shop and other structures are built on piles with the floors about 10 ft. above the ground level; the piles, spaced 8 to 10 ft., are driven about 15 ft. into the soft mud.

For the construction of the bridge piers, twenty barges have been provided, eighteen of which were built new. The power barge, 32x100 ft., is provided with three boilers, two air compressors, a lighting plant, pumps, air receivers and other equipment. This barge is provided mainly with a view to the possible necessity of sinking by the pneumatic process. One of the compressors can furnish air at 100-lb. pressure for operating pneumatic hammers.

The concrete barge, 36x84 ft., is equipped with a sand and gravel bin, concrete mixer, two derricks, two hoisting engines, a boiler for furnishing steam for all engines, a lighting plant, water and fuel tanks. One derrick is placed so as to transfer the sand and gravel from barges to the bin and the other takes the buckets from the mixer and places the concrete in the pier. As already noted the concrete mix is to be too dry for chuting into place.

For excavating material within the steel shell there are two dredge barges 32x72 ft., each equipped with 50-hp. hoisting engines, boilers, a derrick and a light-

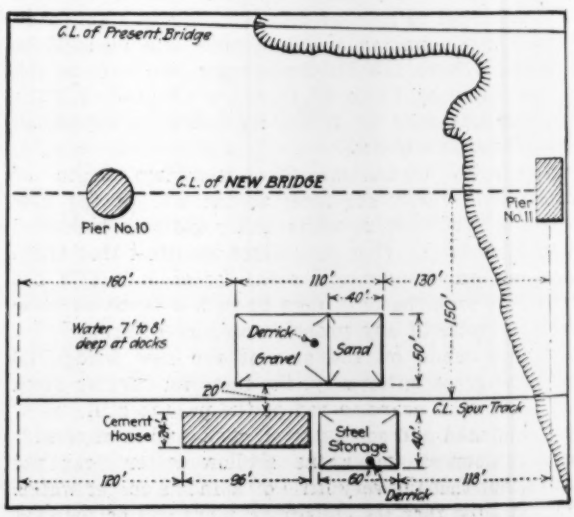


FIG. 5—MATERIAL STORAGE DOCKS

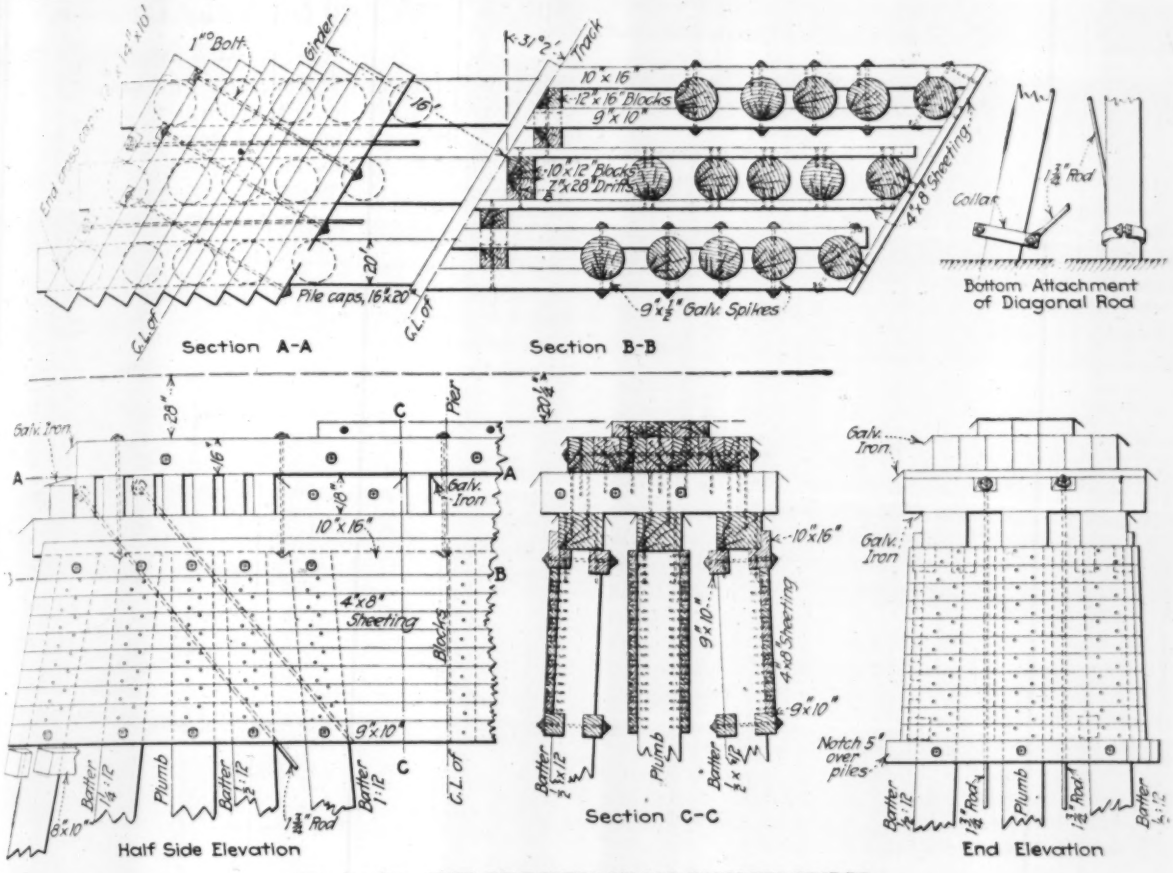


FIG. 7—SHEATHED PILE PIERS OF OLD RIGOLETS BRIDGE

ing plant. Two other derrick barges, 26x64 ft., are equipped with 30-hp. hoisting engines, derrick and lighting plant. Other equipment includes a pile driver barge 26x64 ft., with engine and leads; two cement barges 26x64 ft., with houses; three material barges 20x64 ft. for transferring piles, steel and timber; one fuel-oil barge 16x48 ft., two water barges 18x60 ft., two sand barges 24x70 ft., two gravel barges 24x70 ft. and one gravel barge 25x75 ft.

On a pontoon barge 44x44 ft. the steel cylinders will be built to a height of about 14 ft. and then launched. This pontoon is open on top, with sides about 9 ft. high and floor timbers 12x12 in. running in both directions. After the steel shell is built to the required height, plugs will be pulled and the barge permitted to fill with water. One side of the barge, which is hinged, will then be lowered and the steel cylinder launched into the water and towed into position. There are also a steel tug, a gasoline launch and skiffs.

Adjacent to the steel dock a derrick has been erected for transferring the steel from the cars to the dock and from the dock to the pontoon barge and also for building on this barge the bottom 14-ft. sections of the steel cylinders. On the gravel dock is a revolving derrick with a 60-ft. boom, which transfers the sand and gravel from the cars to the docks and from the docks to the barges. Dredging in the pier cylinders will be done by two 1½-yd. clamshell buckets and concrete materials will be handled by three ¾-yd. clamshell buckets. All derricks are provided with bullwheels and swinging engines.

There are a number of pumps, including two with 10-in. suction and 8-in. discharge for operating jets while sinking the cylinders, and also two hydraulic excavators for excavating the material in the cylinders if it is found possible to handle the material in this manner. A high-pressure oil-engine air compressor is provided on the steel dock for operating pneumatic tools used in building the steel cylinders in the pontoon

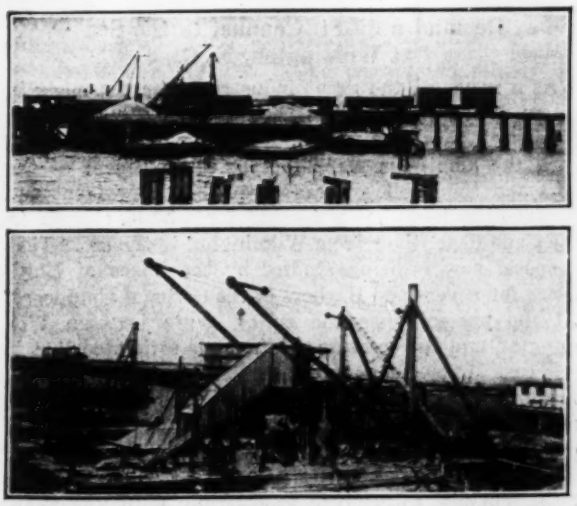


FIG. 6—CONSTRUCTION PLANT FOR RIGOLETS BRIDGE
Above, material storage dock and spur track. Below, floating concreting plant.

barge. There are also air locks, air receivers, feed-water heaters, riveting hammers, calking hammers pipe threading machines and the necessary blocks, lines and other small equipment. A diving outfit has been provided in case it may be required in overcoming obstacles in sinking.

The railroad company is building the approach trestles, already mentioned. It has begun filling them with clay excavated under water at a point about twelve miles east of the bridge, as the ground is so low and flat that no dry filling material is available within reasonable hauling distance.

Old Pile Piers—Creosoted yellow-pine piles for the pile piers of the present bridge were of extra large size and 70 to 100 ft. in length, driven with a penetration of 30 to 40 ft. or as much as it was practicable to secure without damaging the piles. Typical construction is shown in Fig. 7. Piers under deck-girder spans constructed before 1910 had 16 piles each. In the later work the number of piles per pier was 30 under through girder spans, 22 under deck girder spans and 34 for piers supporting adjacent through and deck spans. All piers were braced by diagonal rods placed by a diver, and those under through girder spans had horizontal plank sheathing down to the water line on both sides and ends. In the majority of cases where spans were carried away by violent storms the piles were broken off near the mud line, the entire pier being washed out or a few piles of the pier left standing.

Engineers—Designs for both the substructure and superstructure of this bridge were prepared by the engineering department of the railroad, under the direction of W. H. Courtenay, chief engineer, Louisville & Nashville R.R.; J. M. Salmon is bridge engineer; and G. R. Smiley, chief engineer of construction, has general supervision of the work. George G. Bryson, resident engineer, with a staff of assistants, gives his whole time to the work. For the contractors the construction will be under the supervision of E. H. Connor, chief engineer, and C. F. Creever, general superintendent of the Missouri Valley Bridge & Iron Co., with D. W. Hedrick as superintendent in direct charge of the work. The estimated total cost of bridge and approaches is $3,200,000.

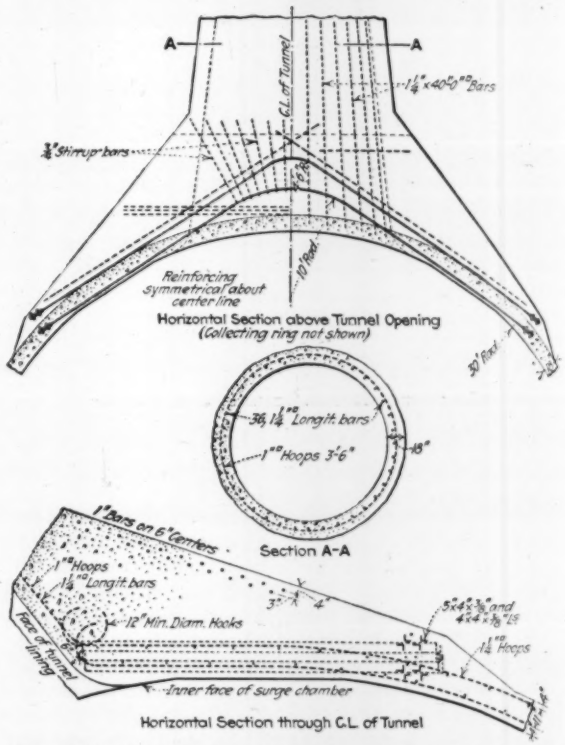
Demand a 30-Ft. Channel to the Sea at Wilmington, N. C.

As a result of the great industrial progress made in North Carolina, there has been an increasing demand for better port facilities at Wilmington, N. C. Along with the ambitious plans for the improvement of the port and the public ownership of the water front and its facilities has come a demand for a 30-ft. channel in the Cape Fear River from Wilmington to the sea. That proposal now is being studied by the Board of Engineers for Rivers and Harbors of the Corps of Engineers. At the present time the ruling depth between Wilmington and the ocean is 26 ft. It is estimated that it will cost $1,500,000 to provide a 30-ft. channel. While it is admitted by the proponents of the deeper channel that only a small percentage of the ships which likely would call at Wilmington would require more than 26 feet of water, it is pointed out that they must have at least a 30-ft. channel to compete successfully with Savannah, Charleston and Norfolk. Savannah and Charleston have 30-ft. channels. The ruling depth at Norfolk is 40 feet.

Surge Tank and Spillway Combined On Pit River Plant No. 1

Heavily Reinforced Cylinder 60 Ft. in Diameter Provides 1,800 Sec.-Ft. Spillway Capacity Between Tunnel and Penstock

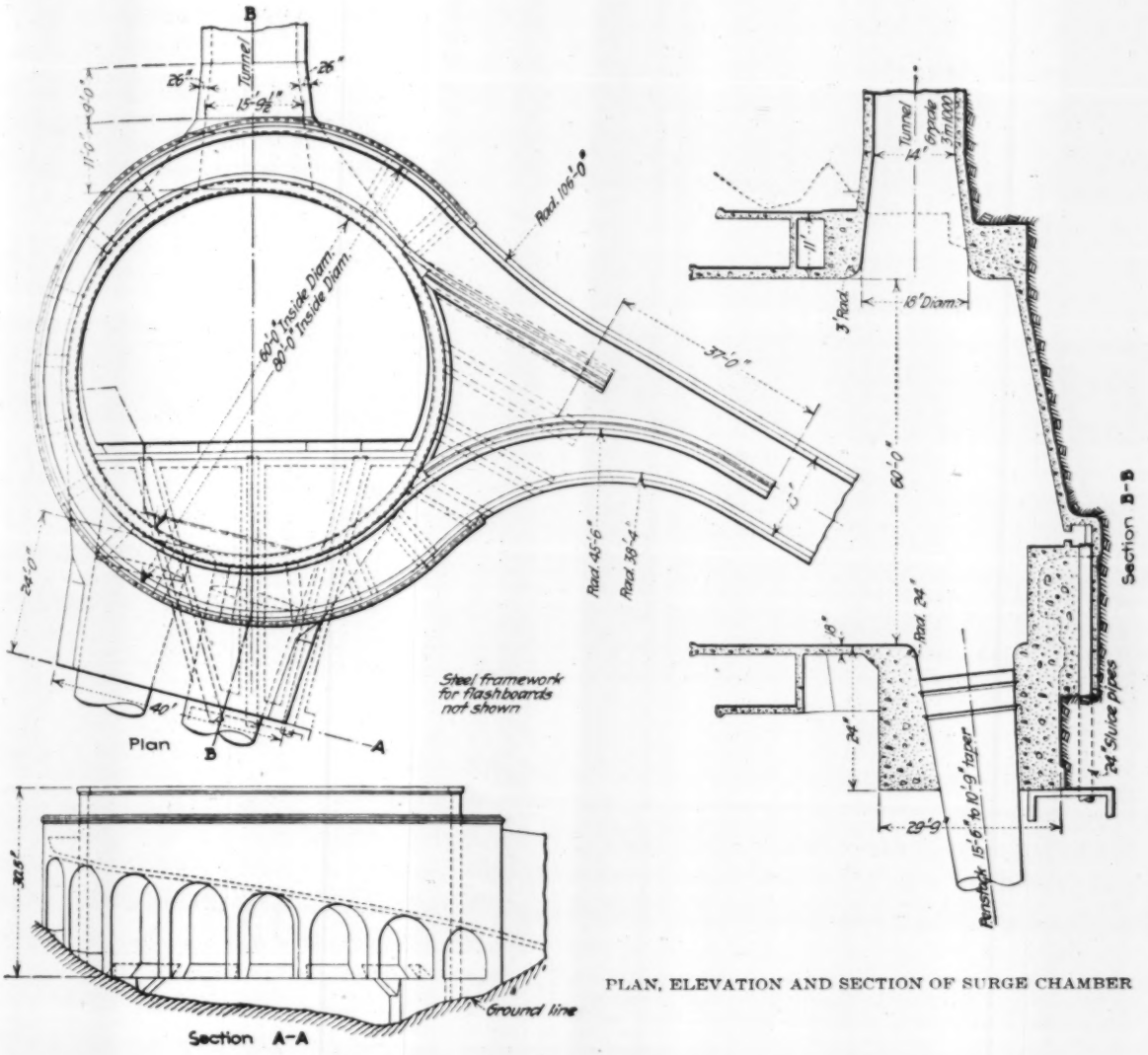
THE SURGE chamber on the Pit River No. 1 development of the Pacific Gas & Electric Co. is designed so that it may also function as a spillway to discharge for short periods the full capacity of an 1,800-sec.-ft. pressure tunnel. This was made necessary by the exceedingly flat grade in Fall River whence this plant takes its water supply and in which raising the water surface a few inches at the diversion dam would back up the water for a mile or two upstream and overflow low farm lands bordering the river. Because of peculiar subterranean storage conditions, annual fluctuations of the surface level of Fall River are normally less than 16 in.



REINFORCING BETWEEN SURGE CHAMBER AND TUNNEL

The combined surge chamber and spillway is located as a connecting link between a two-mile concrete-lined tunnel and two steel penstock lines. The lower end of the tunnel is a circular section 14 ft. in diameter and the two steel penstocks are 10 ft. 9 in. in diameter at the upper end. These large openings into the surge chamber introduce complex structural problems in its design. The development of Pit River No. 1 project as a whole was described in *Engineering News-Record*, Oct. 5, 1922, p. 570.

The surge chamber is built of reinforced concrete; it has an inside diameter of 60 ft., a depth of 62 ft. and an external collecting chute or trough encircling the cylinder and leading to a concrete wasteway. The crest of the circular spillway is set at an elevation 6.17 ft.

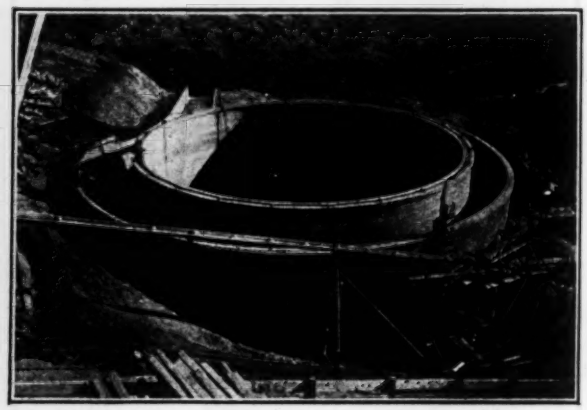


PLAN, ELEVATION AND SECTION OF SURGE CHAMBER

below that of the diversion weir in Fall River, and is provided with a steel frame about 10 ft. higher for such flashing as the operation of the plant may warrant. The encircling trough is of variable width and depth, designed to carry a flow of 1,800 sec.-ft. Baffle or guide walls are provided in the chute at the lower side to prevent excessive splashing and to keep the waves from jumping over the outer walls. This collecting trough delivers into a concrete chute 15 ft. wide by 8 ft. deep which in turn discharges over a precipitous cliff some 300 ft. above the bed of Pit River.

In drawing plans for the surge chamber and spillway consideration was given to the storage and head required to bring from no load to full load within a reasonable time the two 35,000-kva. generators in the plant served. Fall River is about 200 ft. wide and its flat gradient affords sufficient storage to permit of some desired peaking. It was deemed possible to draw from the river more rapidly while peak loads are being carried and to allow the storage to accumulate during the hours of low load. It was thought that a minimum flow through the plant of 900 sec.-ft. might obtain and the finished concrete crest of the surge chamber was established at an elevation 1 ft. above the computed hydraulic radiant under this condition of flow. After operating the plant for several months it was at times found possible to reduce the flow to considerably below this amount. Consequently flashboards have been added to permit of raising the water level in the surge tank 3 ft. above the original crest, in order not to waste water during low load hours.

In order to confirm opinions relative to the behavior in the collecting and spillway chutes and especially the height and shape of the various walls required, a small model was made of Spanish cedar to a scale of 1 to 60, the inside diameter of the model being 12 in. Various baffle walls or throat sections were made such that they could be readily inserted between the established surge chamber tank and spillway sections. Water was admitted at the bottom of the tank and allowed to flow over the crest at varying depths. There was a decided tendency for the water to crowd over the outer wall at and near the high points in the floor of the connecting trough, even though a split-water vane was provided. This wall was therefore raised about 3 ft. in working out the final design.



SURGE CHAMBER NEARING COMPLETION
Tunnel enters from left and penstock foundations are being placed at right. The chute discharge over the cliff appears in left background.

Baffle walls of various shapes and curves were tried, as was also a section with no baffle walls. The crest of the water surface under each condition was measured from the top of the outer walls at stated intervals and these measurements plotted. The combination which gave the smoothest results was adopted and constructed. While the full 1,800 sec.-ft. has at no time passed over the surge chamber, the results as noted from smaller flows are reported to be very gratifying and in close relation to those observed in the model.

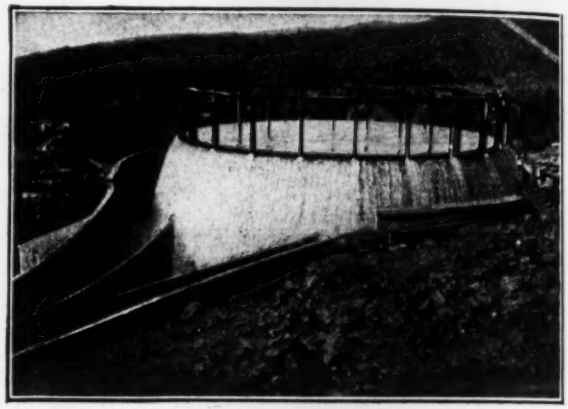
The shell of the surge chamber was designed to resist hydrostatic pressure in tension with a maximum stress in the steel of 12,000 lb. per square inch. The main reinforcement consists of hoops made of square corrugated bars; these hoops were made in two different diameters which were placed alternately so as to stagger the position of the bars with reference to inner and outer faces of the walls. The size of the bars in these hoops increases from 1 in. at the top to 1¼ in. at the bottom and the spacing between hoops, vertically, decreases from 8 in. at the top to 4 in. at the bottom. All laps were made not less than 40 diameters and were staggered vertically in the rows. The laps in the inner row were also kept staggered from those of the outer row. Vertical bars, ¾ in. in diameter, were spaced on 2-ft. centers.

The stresses concentrated in the shell of the surge chamber at the tunnel opening total about 1,000,000 lb. and are effective in a direction tangent to the cylindrical reinforcement. A structural steel bridle was designed to transmit the stresses above and below the opening, with an arrangement of reinforcing shown in the accompanying illustration. The vertical members at either side consist of four 5x4x⅜-in. angles, four 4x4x⅜-in. angles and four 1¼-in. square bars. All of this acts as tension reinforcement for a concrete beam about 7½-ft. deep into the compression side of which are hooked the 1¼-in. square bars used as hoop reinforcing. Two sets of six 1x6-in bars tied these members together at the top and bottom. The inward component of stress or pull was provided for by thoroughly tying the whole anchor block in which the bridle is built to the concrete lining in the tunnel. The tunnel lining is reinforced longitudinally for a distance of about 70 ft.

The penstock openings were handled in very much the same manner, except that advantage was taken of the weight in the top penstock anchor to resist the inward forces. This anchor was increased sufficiently [illegible] dimension to carry safely any and all combinations [illegible] forces that might act thereon.

The collecting chute was designed as a con[illegible]e "L" section with reinforcing tied into the main sh[illegible] of the surge chamber and supported on wall piers carr[illegible] down to bedrock. The downhill or front elevation wa[illegible] treated as a series of arches for architectural reaso[illegible] only. The laying out of the supporting pier was made somewhat difficult due to the fact that the outside circle was not concentric with the surge chamber, the width of the trough being gradually increased from 5½ ft. at the high point to 10½ ft. at the junction with the tangents from the outer walls of the spillway chute.

The main section of the spillway chute is 15 ft. wide and 8 ft. deep and has a grade of 1 in 7. The side walls are 10 in. thick, designed as L-section retaining walls. The floor is 8 in. thick tied into the sides with reinforcing bars. The chute is located off center with respect to the surge chamber in order to fit the ground contour to best advantage. In order to prevent sloughing of the cliff below the chute from endangering the



SURGE CHAMBER SPILLING
Supports for walkway, on which hand railing is not yet placed, will serve as ashboard guides.

concrete structure, the lower 54 ft. of this chute is designed as a self-anchored cantilever resting on a substantial pier placed some 25 ft. back from the edge of the cliff. Although serious sloughing is not expected the lip was flattened to a horizontal grade and was extended some 5 ft. beyond the edge of the cliff in order to keep the drip well down on the bluff.

The steel frame for flashboards was designed with vertical guide beams or posts at 8 ft. 1 in. centers, tied at the bottom with channels and at the top with angle bands or hoops located along the chords of the circle. No diagonal bracing of any kind was used.

The surge chamber structure was constructed by company forces and considerable difficulty was experienced from the fact that the tunnel operations were under contract and incomplete at the time this work was under way. This complicated the work at the portal entrance.

Concrete was of a 1:2:4 mix throughout. Crushed lava rock from the tunnel dump and a good quality of local sand were used. Hydrated lime in the proportion of 10 per cent by volume of cement was incorporated in the mix. Some leakage appeared immediately after the water was turned into the surge chamber but this soon disappeared and since that time the walls and the bottom are reported to be practically watertight.

Cold Storage Warehouse Has Unusual Design

Insulation Requirements Complicate the Design—Railway Track Enters at Third Floor Level—Asphalt and Plaster Wall-Coating Put On With Spray and Cement-Gun

By Stewart T. Smith
Architectural Engineer with Van R. H. Greene, New York City

A LARGE brick and reinforced-concrete warehouse of notable design is now being erected for the Terminal Refrigerating & Warehousing Co. in Washington, D. C. The building has a ground area of 29,000 sq.ft., and will include space for cold and dry storage and an ice-making plant of considerable size. The insulation requirements for the cold storage space have introduced some unusual features in the design. The building site is east of 4½ St. S.W. and between D St. and Virginia Ave., where the zoning restrictions allow a total height of only 85 ft. from top of curb to top of parapet wall. In order to secure the greatest amount of floor area, the stories are made 10 ft. high, the roof flat, and the parapet wall only 6 in. high. This arrangement allows the building to have eight stories and a basement.

The floor space of the building is divided as follows: 101,000 sq.ft. of dry storage, 50,000 sq. ft. of cold storage, where goods are kept at a temperature of from 32 to 40 deg.; and 25,000 ft. of space for freezers, where goods are kept at a temperature of from 14 to 32 deg. There is also an ice-making plant of a capacity of 150 tons per day, and storage space for 900 tons of ice. Refrigeration is provided by four compound motor-driven ammonia compressors which provide 450 tons of ice and require 2,000 electrical horsepower per day. The ammonia condensers are located on the roof of the building

Local truck service for the building is from the ground floor on D St. and railway service by a spur from the Pennsylvania R. R. which runs into the building at the third floor level. The present track has a capacity of six cars, and the structural frame of the building is so arranged that bays in the third and fourth floors south of the present track can be removed to provide space for a second track. Two elevators

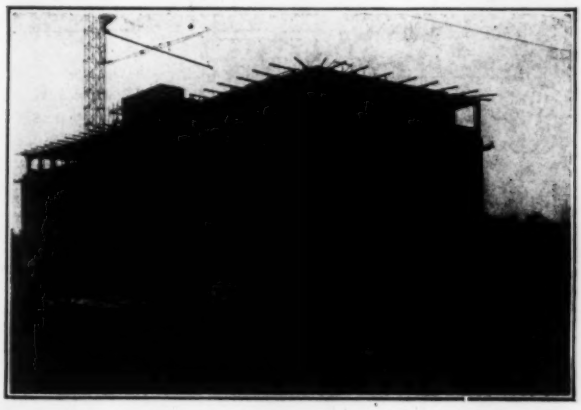


FIG. 1—D ST. ELEVATION

9 x 17 ft. are provided for the dry storage side of the building, and two elevators 9 x 9 ft. for the cold storage side of the building. The cars of the latter elevators are provided with special rubber flaps around the edges

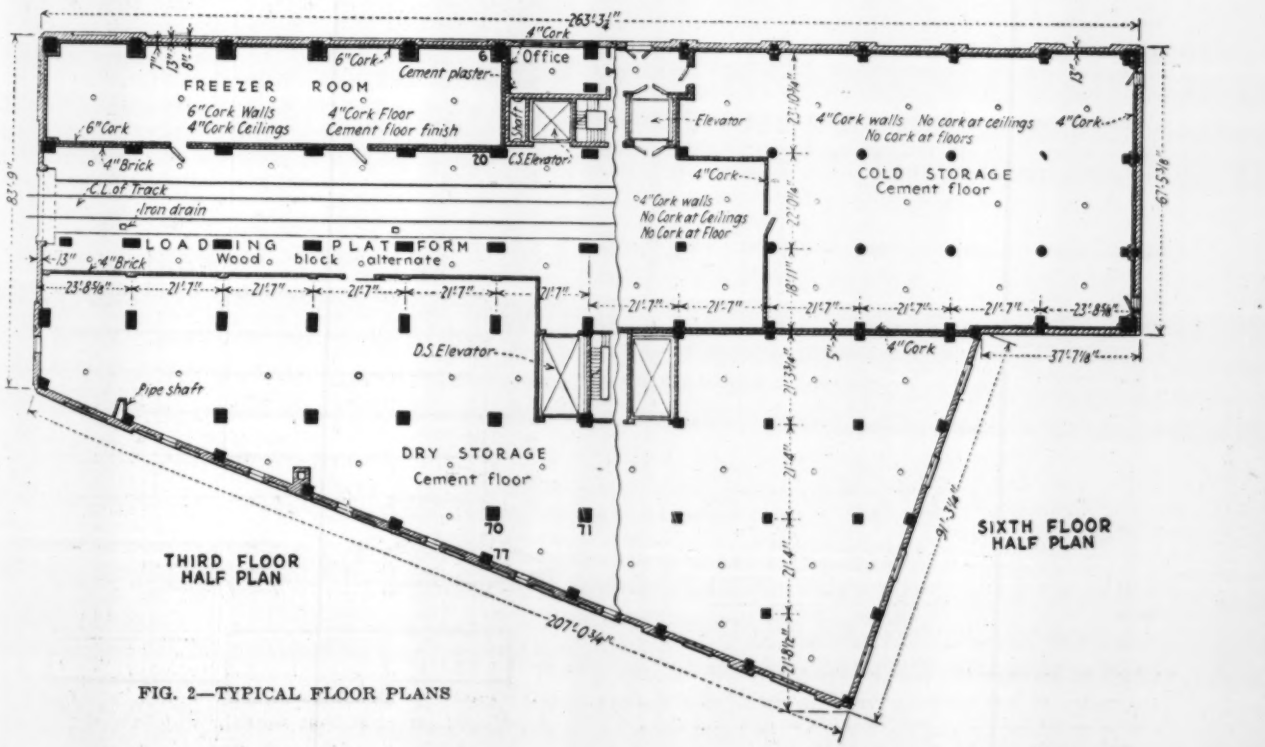


FIG. 2—TYPICAL FLOOR PLANS

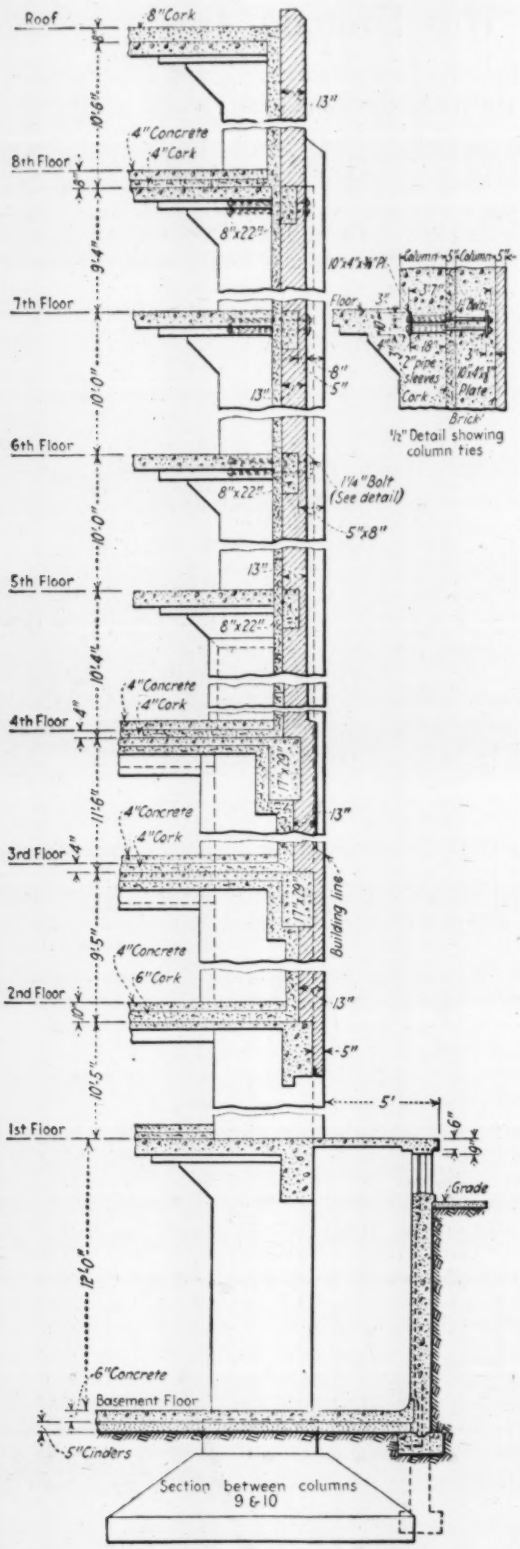


FIG. 3—DETAILS OF THE INSULATION

which fit between the car and the hatchway, preventing the escape of refrigeration from the room when the cars are at any landing and the doors of the room open.

Structural Features—The first four floors in the south half of the building are designed for live-load of 300 lb. per square foot. All other floors are designed for a live-load of 200 lb. per square foot. This is in addition to the weight of the insulation and wearing surfaces, where insulation occurs on floors.

Beam and girder construction is used for the entire south half of the building and for the second, third, and fourth floors of the north half. The first, fifth, sixth, seventh, and eighth floors and the roof in the north half are all flat-slab construction with drop panels. For all flat-slab design the revised Chicago Code was used with the exception that a stress of 16,000 lb. per square inch for the steel was used to conform with the local code. The location of the columns in the north half of the building was fixed by the dimensions of the freezing tanks in the basement.

The footings rest on a hard formation of clay and gravel and were designed for a soil bearing capacity of 8,000 lb. per square foot.

The columns have a mix of 1:1:2 and rest on pedestals of 1:2:4 mix. A mat of steel is provided in the top of the pedestals to properly transmit the stress over the larger area of the pedestal.

Around the cold storage portion of the building the columns are solid up to a point approximately 7 ft. below the fifth floor. From this point up columns are split to provide for insulation, and wall beams are provided at alternate floors to carry the walls. The anchors which are used to anchor the wall columns to the framework of the building are made of 1¼-in. bolts set in pipe sleeves to allow for expansion and contraction.

The supports for the railroad tracks are designed to carry a Pennsylvania engine, total weight of engine and tender 158 tons, and a 126-ton hopper car, plus 50 per cent of live-load for impact. The columns between the present track and the future track, from the second to the fourth floors, were considered as one unit with an unsupported height of 25 ft.

The usual wall girder for flat-slab design was eliminated and no increase in the slab thickness was provided at the wall line. With the elimination of the weight of the wall on the structural frame of the building, it was considered best not to invite additional stress to the edge of the slab by placing a wall girder there.

Retaining walls were designed as slabs from column

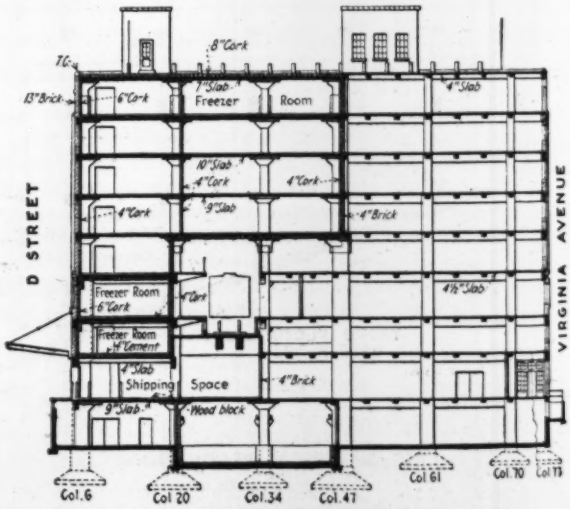


FIG. 4—VERTICAL SECTION OF THE BUILDING

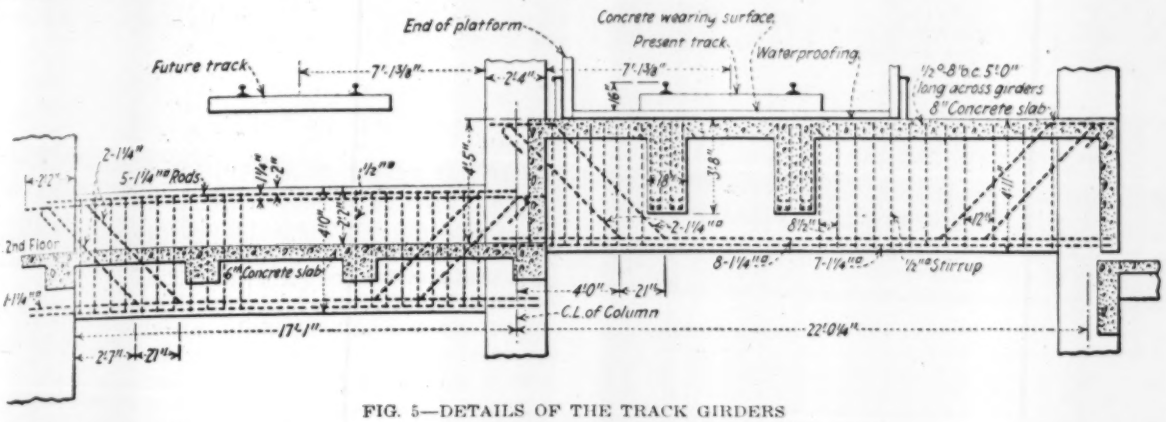


FIG. 5—DETAILS OF THE TRACK GIRDERS

to column with the exception of those along D Street, which were considered as slabs from floor to floor. All retaining walls and the entire basement floor are waterproofed with an integral waterproofing compound.

Insulation Details—All cold storage and freezer rooms are grouped together on the north side of the building and completely insulated with cork. Two layers of pure compressed corkboard in slabs 12 in. wide x 36 in. long and 2 or 3 in. thick, depending on whether the total thickness was to be 4 or 6 in., were used for this purpose. To make this insulation as continuous as possible the walls of the cold rooms were made separate from the structural framework of the building by providing a separate framework to support the walls around the cold storage section. This framework is anchored to that of the building at each floor level. The insulation between the north half and the south half of the building above the fifth floor virtually splits the building into separate units.

Where insulation was applied to the floors, the concrete slab was mopped with asphalt and the first layer of cork was set in this asphalt. This layer of cork then received a heavy mop coating of hot asphalt and the second layer of cork was laid in it while hot, breaking joints with the first layer in both directions. The top surface was mopped with asphalt and a one-ply waterproofing fabric was laid over the entire area, after which a 4-in. concrete wearing surface was applied.

At the roof the same method of construction was used as on the floors, with the exception that the concrete wearing surface was eliminated and the roofing took the place of the fabric.

Where walls were to be insulated, they were first cleaned of all loose particles and then two coats of hot asphalt were shot on with a special gun, filling all the surface pores of the walls and completely damp-proofing them. Two layers of cork were then set up in asphalt the same as on the floor except that the second layer is held in place by the use of wooden skewers. The exposed cork surface is plastered with a cement plaster containing 10 per cent of hydrated lime. The plaster was applied with a cement gun—a departure from the ordinary two-coat hand job for this class of work. The plaster is scored off into 4-ft. squares to prevent unsightly cracking.

Where cork is affixed to a ceiling the first layer was laid in the forms and the concrete poured over it. The second layer was set up in asphalt against the first after the forms had been removed and held in place by wooden skewers. The exposed cork surface received a plaster finish as on the walls.

Insulated partitions were made by the use of the two layers of corkboard, set together in cement plaster and both exposed cork surfaces plastered. Care was taken to get all rooms completely insulated, and where the corkboard could not be made continuous it was arranged in such a way that heat must travel about 4 ft. through masonry work before entering the cold rooms.

The architectural features of the building were designed by Appleton P. Clark, Jr., architect, of Washington, D. C. The writer had charge of the structural design of the building. All mechanical equipment and refrigerating details were designed by Van R. H. Greene, refrigerating engineer, New York City. The building is being built by the Consolidated Engineering Co., Inc., Baltimore, Md.

Effect of Oil-Well Water on Cements

A study of the effect of various oil-well waters on the setting of cement is being made by the Department of the Interior at the petroleum experiment station of the Bureau of Mines, Bartlesville, Okla. Petroleum engineers of the Bureau of Mines in the course of their investigations are frequently told by operators that the chemical characteristics of waters in their wells will prevent cement from setting. Where surface tests have been made at these wells, it has invariably been found that a good grade of cement properly mixed will set in water from the well. This indicates that conditions in the well such as movements of fluid, agitation by gas, or improper preparation of the hole for cementing are among the causes for the failure of the cement to set. The bureau's engineers are, however, not convinced that cement will set in all oil-field waters and therefore are striving to obtain samples of oil-field waters where difficulty has been experienced in securing a proper set. By collecting numerous samples of waters from various fields in the United States and making tests with cement it is hoped that useful information may be obtained regarding cement failures in wells. The bureau is therefore requesting oil operators to furnish samples of waters from wells where difficulty has been experienced in securing a proper set. Water samples should be sent to the petroleum experiment station, Bureau of Mines, Bartlesville, Okla., accompanied by a data sheet stating owner and well number, location and depth of well, and information regarding the method of obtaining the sample.

Through the Reclamation Country

By F. E. Schmitt
Associate Editor, *Engineering News-Record*

A SERIES OF ARTICLES on Federal Land Reclamation is to start in *Engineering News-Record* next week. It will give a history of the twenty-one years of government irrigation, state the many problems of operation—engineering, agricultural and financial—analyze the various complaints that are being so emphasized by those who are seeking a reform of the current law and methods and seek to present some views as to a constructive policy in the future. Through it all will run the evident theme that irrigation, from planning, through construction to operation, is a continuing engineering problem.

As a part of the preparation of the series Mr. Schmitt is now traveling through the West, visiting irrigation projects, studying developments and interviewing builders, operators and settlers. He will write a series of letters of running comment on the situation as he sees it on the ground. These are not the final result of his trip but they will serve to acquaint our readers with the actualities of reclamation as revealed to an unprejudiced investigator.

This is the third letter. The first appeared in the issue of October 4.—*Editor.*

Hermiston, Ore.

DIFFERENT farmers on reclamation projects take different attitudes when interviewed as to farming conditions and prospects. While generally they complain of low prices for farm products, high prices for all other commodities, and excessive freight rates, some farmers take a more hopeful view than others. On one point all agree: that their condition and the condition of the project would be entirely different, and that they would be doing nicely, if it were not for the effects of the war-time boom and the subsequent forced deflation—the worst in three or four decades. They pay 50 or 100 per cent more than they receive, and they resent it.

Farmers in other parts of the country also are having a hard time of it, and for the same reasons. The reclamation projects are in the same trouble as the farming regions east of the 100th meridian. Yet the condition of the reclamation farmer is blamed on the unbusinesslike and unsympathetic engineer, while the general farmer's condition isn't blamed on anyone in particular.

Unlike the general farmer, the reclamation farmer has ready-made grievances for his troubles, in the shape of the government's water and construction charges, and he can demand of his political representatives that they procure deferment of the charges. These charges are no greater than his taxes, and much less than the interest payment on his mortgage debts; but, though the government charge is theoretically a prior obligation, it can be deferred, while taxes and interest can not. In fact the government claim has pretty well ceased to be a prior lien at all.

Politics in Reclamation—Politics enters into the reclamation business, therefore. It does today and it seems to have done so from the early days on.

The Reclamation Service was not always free to select the most promising projects, and it had some very doubtful projects forced on it.

The reclamation law directed that the attempt should be made to expend in each state the money originating in that state (from sale of public lands), a concession to local jealousies. While the rule was not followed closely, one of its results is the Umatilla project, surrounding this town, which is not one of the most successful ones; it is hampered by poor soil and at present is only half settled, after a good part of its original area has been withdrawn from the project as not worth irrigating. The Service adopted this project originally because it thought itself obliged to develop a project in Oregon. Umatilla is not strictly a case of political interference, but several other projects are, such as the unfortunate Hondo project, in New Mexico.

Political pressure had the result that on some projects the beginning of repayment by the settler was deferred long after water was supplied; even though the construction charge had been announced and the first payment collected for, the call was withdrawn by the Secretary of the Interior and held up for a number of years, during which time the farmers received the full benefit of irrigation without paying anything but operating charges—a direct loan to them of government money not contemplated in the law. But these and similar special favors to the project settlers were probably less harmful than the demoralization of the relations between the settlers and the Reclamation Service which resulted from constant political agitation of reclamation matters. Public statements by a United States senator that the settlers need not worry about the repayment of the construction charges, and that they might not have to repay them in the end, did not improve the situation.

Several relief bills passed by Congress in recent years further deferred the construction charges. These bills were well-intentioned measures to relieve the hardships produced by deflation. But being blanket measures applying to the worthy and unworthy alike, their effect was neutral or bad rather than good, and they also represent a phase of political in place of business management.

Prominence of Political Influence—The element of political influence forces itself into notice in the present juncture for two reasons. First, it bears directly on the question of operating success of the reclamation projects. A project manager says, "It doesn't seem possible to make a single move without arousing the opposition of one or another interest." Second, the future possibilities of reclamation impregnated with politics appear very menacing with respect to new projects. All sorts of hands are stretched out for money from the revolving reclamation fund. Projects that from an outsider's viewpoint look darkly questionable are being promoted and investigated.

Politics via Washington is perhaps not so serious a matter as local politics, which on a reclamation project almost inevitably centers around reclamation. The men who seek leadership and preferment need issues, and naturally they agitate the farmers' grievances, and the Reclamation Service is the goat. Under private management this particular evil is absent. All that the water users could agitate about is to take over the operation of the system—and this they frequently do not want to do even when it becomes their obligation.

Inflation-Deflation Sequence—Referring to the effect of the price boom and the 1920 deflation, a project farmer said, "Most of the farmers here lost their heads when the war prices came. The wise ones paid their debts and kept the balance of their money; the others bought oil stocks and such like, and some of them even

mortgaged their farms to pay for the stock. Most of them lost their whole investment; and then they were hit by the low prices." Aside from this effect the inflation developed a fantastic rise in land prices and much speculation in land. Farms were sold to adjoining farmers or to outsiders, often on a shoestring. The added burden on the land made the farmers less fit to meet the price conditions later on, when their returns often were less than the cost of production and vast quantities of potatoes were left in the ground or were fed to hogs.

British Sanitary Engineering Practice

Extracts from an address by H. C. H. Shenton, President, Institution of Sanitary Engineers, London, England.

IF IT WERE not for the unceasing work of the engineer, life in our large cities would be impossible. If one follows the course of a drop of water from the time when it is extracted from the river Thames for the London water supply to the time when it again enters the river at Barking or Crossness from the outfall sewer, some idea of the engineers' work may be obtained. It is drawn from a river which receives the drainage of all the Thames Valley above; the sewage of such towns as Oxford and Reading, together with that of innumerable smaller places, houses, factories, etc., enters the Thames above the intake of the Metropolitan Water Board, yet such is the excellence of the work of the sanitary engineer that the water at the intake is practically as good in quality as if it were drawn from the river fifty-five miles higher up. Sir Alexander Houston has shown this. This water is purified by storage, it is filtered, sterilized and pumped, it flows into a system of 6,577 miles of water main, and is eventually delivered for the supply of a house or other building.

English and American House Sanitation—One of the matters most worthy of consideration at the present time is the difference which exists in the practice of English and American engineers. In this country we have for a long time past adopted the principle that all soil pipes shall be kept distinct from bath, sink and lavatory waste pipes. The Americans, on the other hand, appear to use one system of pipes for all purposes. It is obvious that the American system is much more economical than our own, because it saves a double system of pipes, and many branch drains, gullies and manholes otherwise required. If a bath sink or lavatory basin is trapped suitably and if the pipes are ventilated, so that siphonage and air pressure are impossible, it seems that the American engineer sees no objection to the waste pipe being connected direct to the drain or soil pipe. Where this is done there is a saving, first of a separate waste pipe, or system of waste pipes, next of the gulley or gullies into which such waste pipes discharge, next of the branch drains running from the gullies to manholes, and lastly of the manholes themselves, in short about half the expense of the work is saved. Seeing that this applies to every new house built and that the present need for economy is great, the matter is at any rate worthy of our consideration.

The Intercepting Trap—Although it is generally admitted that the intercepting trap would be unnecessary in connection with a perfect sewerage system, it does not appear that the average system of sewers in this country is perfect enough to encourage engineers to use the house vent pipes as sewer ventilators. However, cases exist where the interceptor has been omitted wholesale, apparently with satisfactory results, and it seems as if the matter deserved more attention than it has recently received.

Sewer Pipe Joints—In the author's opinion, insufficient attention is given to the probability of expansion and contraction in concrete pipe lines. The extreme rigidity of the ordinary joints is certainly a drawback, seeing that any movement or settlement tends to cause fracture. The Stanton Hume pipe is made with a double socket, into which cement or lead can be calked. The lead joint no doubt possesses the advantage of slight flexibility. Recently these pipes have been made with ordinary sockets. Some years ago the author used the Brandram joint which consisted of a steel band drawn round the pipe and keyed, while it was covered with hot bitumen. Recently a joint which appears to be somewhat of the same character has been brought forward. The Victualic joint is used for iron and steel pipes. It has been approved by Lloyds for use on ships, and it is also interesting to note that it has been used on a 15-in. cast-iron sewer at Dartford and on a 3-in. steel sewage main at Bradford. The application of this valuable flexible joint to concrete and reinforced-concrete pipes is desirable, but apparently this is still a thing of the future. The cast-iron pipe lined with cement by the centrifugal process is also worthy of note in connection with sewerage work.

Sewage Sludge Utilization—The use of activated sludge as a fertilizer when it is applied to the land is evident. Good results have been obtained; and J. A. Coombs, in the discussion which followed the reading of his paper before this Institution, said, "the first big town which pumps activated sludge over a sufficient area of distribution will be a pioneer of a practice which will be copied everywhere." The problem of drying this material completely for use as a fertilizer will probably be solved in the near future. There are various possibilties. Dr. Hele Shaw's streamline filter is capable of dewatering activated sludge completely at a very moderate pressure and is certainly a very important factor in the case. Activated sludge has been referred to by Dr. Nasmith as if it were of a highly putrescible character. In the author's experience it does not differ greatly from ordinary humus derived from filters.

J. D. Watson, of Birmingham, A. J. Martin, and others have shown that it is possible to utilize profitably the sludge from ordinary digestion tanks. Some of our large towns, like Bradford, Huddersfield and Morley, extract grease from sludge and sell it; elsewhere, as at Kingston-on-Thames, artificial manure is produced. We have the word of Mr. Watson that utilization of sludge is a duty, and there can be no doubt about it, because Mr. Watson has dealt with the problem on a very large scale at Birmingham, and speaks with knowledge.

French Establish Masons' Apprentice School

Paris Correspondence

A NOVEL movement towards the betterment of masons' apprentices is being carried out in France by the Chambre Syndicale des Entrepreneurs de Maçonnerie. A combined home and school has been established in Paris for mason's apprentices where they may perfect their themselves in the diverse specialties of their trade.

It is intended solely for orphans of workers in the building trades who lost their lives in the war and workers who are members of the masons' trade unions.

Pupils are taken from their fourteenth year onward and even if they have already been at work provision is made for those who may be needy to take up such higher branches of their trade as they may be fitted for. Obviously this is an effort to form quickly an added corps of masons in the building trades.

The cost of instruction, food and lodging is at the rate of 7 francs 50 centimes per day, the equivalent of $1.50 at the normal rate of dollar exchange. After passing technical and practical examinations, the pupil receives a diploma and is granted the grade of "companion," in all save point of age and extended experience a full fledged working mason.

This institution has attracted the attention of the French Under-Secretary for Technical Education and is to be closely associated with the Ecole Pratique d'Industrie which is under reorganization.

Pollution of Water Supplies by Coal Mine Drainage

Serious Character of Acid Mine Drainage Shown by Study in a Pennsylvania Bituminous Mining Area—Lime Treatment of Mine Drainage and Other Remedies Considered

By C. P. Collins
Consulting Engineer, Clarksburg Engineering Co., Inc., Clarksburg, W. Va.

POLLUTION of public water supplies by mine drainage has become a serious matter in some parts of the country, particularly in the bituminous districts of Pennsylvania. In 1920, the writer, together with a number of other engineers, was called upon to investigate this problem in Fayette County, Pa., where subsequently the Mountain Water Supply Co., with the Dunbar Water Co. and Pennsylvania R.R. Co. as co-plaintiffs, were pitted against the Sagamore Coal Co. and twenty-eight other coal companies in the most

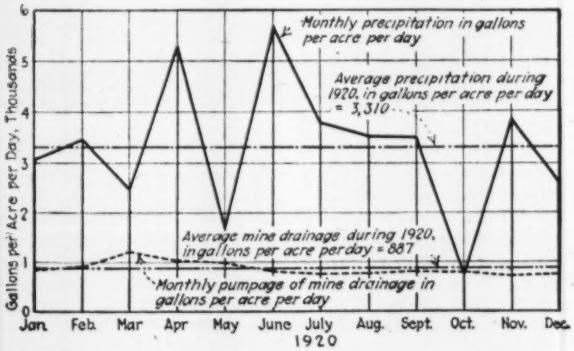

Monthly precipitation in gallons per acre per day
Average precipitation during 1920, in gallons per acre per day = 3,310
Average mine drainage during 1920, in gallons per acre per day = 887
Monthly pumpage of mine drainage in gallons per acre per day
Gallons per Acre per Day, Thousands
0
1
2
3
4
5
6
Jan. Feb. Mar Apr May June July Aug. Sept. Oct. Nov. Dec.
1920

FIG. 1—RELATION BETWEEN COAL MINE DRAINAGE AND RAINFALL

important case ever brought in the courts to restrain stream pollution caused by drainage from bituminous coal mines. (No. 1023 in Equity, 1921, Fayette County, Pa.; decided in favor of the coal companies Dec. 26, 1922.) Some of the data gathered by the writer for use in behalf of the water companies will be presented in this article.

In 1904, the plaintiffs built a 251-m.g. storage reservoir on Indian Creek, about 4½ miles above its junction with the Youghiogheney River, in Springfield Township. The reservoir had a drainage area of 109 square miles about 60 per cent of which is underlaid with Lower Measures coal. A 36-in. cast-iron pipe line, with two branches, conveys water from the reservoir to Pittsburgh, one branch via Greensburg and one via Brownsville. Water for railroad purposes is supplied along the pipe line, besides which a large volume of water for municipal purposes is delivered by the Westmoreland Water Co., in the County of Westmoreland. It was alleged that coal mine drainage injured the water for both industrial and commercial purposes. When the dam was constructed the waters from the streams in this area were unsurpassed in purity, with the drainage of only a few mines entering them, whereas at present they receive drainage from about 38 commercial mines. The object of the investigation in which the writer took part was to determine the probable life of the water-supply works if coal mining was to continue without check.

Geological Considerations—During the initial stages of coal mining, considerable water finds its way through the slates and shales immediately above the coal seam and thus enters the mine workings. After the room pillars have been drawn, the breaking of the roof and superincumbent strata disturbs the natural reservoirs above, and much more water is, therefore, encountered than in the initial stages of mining. The amount of water which may be expected from a given area of virgin coal, and from the area where pillars have been removed, is wholly dependent upon local conditions and cannot be estimated without a careful study of the flow from mines where like conditions obtain.

The height above the coal to which the disturbance reaches after the pillars are removed is dependent upon the condition and character of the strata above the coal. In some cases the height of the disturbance is very great. To the writer's personal knowledge, pronounced cracks have appeared on the surface where the cover over the seam was 475 ft. This is an unusual case but heights as great as 250 ft. have frequently come under his personal observation. It is evident, therefore, that the drawing of pillars may at times have a far-reaching effect and thus greatly increase the amount of water entering the mine workings.

Quantity of Mine Drainage—To ascertain the quantity of mine drainage that may be expected from a given area of coal, mined under the conditions that obtain in the bituminous coal region, investigations were made in Somerset, Cambria and Westmoreland counties in addition to those made in Fayette County, in Western Pennsylvania. About 30,500 acres of exhausted territory, exclusive of Fayette Co., were covered.

V-notch weirs were placed at various drainage outlets, and careful determinations were made of the area of coal mined out from which the drainage was collected. At all gaging stations, the depth of cover, the character of the overlying strata, and the thickness and quality of the coal were carefully noted. The investigation included all the mines on a given drainage area. After the total flow of mine drainage was determined, the flow of the main stream below the last point of outlet was measured by submerged floats, and under the same weather conditions as obtained during the gaging of the mine drainage. Care was exercised to obtain results indicative of average flows.

TABLE I—MONTHLY PUMPAGE OF COAL MINE DRAINAGE AT CENTRAL STATION, NEAR JOHNSTOWN, PA., AND RAINFALL AT JOHNSTOWN

Months (1920)	Pumpage, Million Gallons	Precipitation, Inches
January	114.1	3.49
February	111.7	3.57
March	166.5	2.83
April	135.1	5.86
May	131.5	1.94
June	106.4	6.26
July	107.3	4.32
August	104.3	4.02
September	104.5	3.86
October	108.8	0.87
November	94.5	4.27
December	101.5	3.00
Totals	1,386.2	44.29*
Monthly averages	115.5	3.69

* The total precipitation for the year 1920 was 3.07 in. below the yearly normal.

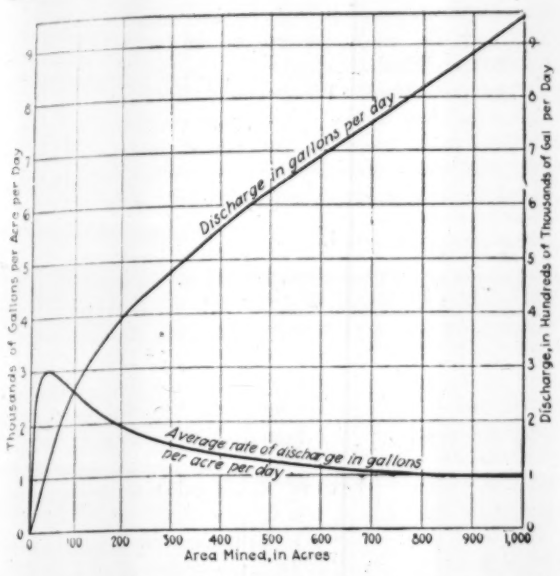


FIG. 2—AVERAGE RATE OF MINE DRAINAGE FLOW AND DISCHARGE FROM VARIOUS MINED-OUT AREAS

Mine Drainage Flow in Relation to Rainfall—To study the fluctuations in the flow of mine drainage and the relation of mine drainage flow to rainfall, the records of a large central pumping station near Johnstown, Pa., covering the year 1920, were used. This pumping station received the drainage from 4,282 acres of mine workings, the depth of cover averaging about 250 ft.

Table I shows the monthly pumpage in million gallons per day, and also the precipitation in inches at Johnstown, Pa., for the year 1920, as obtained from E. C. Lorentz, the observer for the U. S. Weather Bureau. The average mine drainage for the year 1920, as shown by the diagram (Fig. 1) was 887 gal. per acre per day, whereas the average precipitation for the same period amounted to 3,310 gal. per acre per day, making the mine drainage 26.8 per cent of the precipitation. This also represents the percentage of percolation through the strata. A study of the diagram clearly shows that the flow of mine drainage is comparatively constant, resembling closely the flow from permanent springs. The minimum mine drainage flow at the station for the year 1920 occurred in November, and was 736 gal. per acre per day, or 83 per cent of the average flow. In other words, we find the minimum flow to be only about 17 per cent less than the average. While precipitation is subject to daily and monthly variation, the mine drainage has only a seasonal variation, excepting where the workings are near the outcrop.

Conditions Governing the Rate of Mine Drainage—Mines operating under a light cover and near the outcrop have a much higher rate of flow than those under deep cover. After the pillars have been drawn, and the strata above the coal are broken, the rate of flow will be greatly increased. In the early stages of development, and even before the pillars have been drawn, we find a higher rate of flow than obtains after the workings are farther advanced.

Fig. 2 shows the average rate of flow in gallons per acre per day, together with the discharge for various areas mined out. The curves have been plotted from actual measurements, only average flows being considered. The areas mined out in every case were accurately determined, and included both large and small areas. The curve representing the average rate of flow in gallons per acre per day has been plotted from the results obtained in several counties of Western Pennsylvania, covering in the aggregate about 30,500 acres mined out. It is the opinion of the writer that the rate of flow shown by the curve is representative of what may be expected in the bituminous region, where the depth of covering ranges from the outcrop to that of an average of 250 ft. It will be seen that after about 800 acres have been mined out the rate of flow is quite constant.

Quality of Mine Drainage—Sulphur and iron appear in the coal in the form of pyrites, which, coming in contact with air and water, causes chemical changes which produce an acid drainage. The degree of acidity is largely influenced by the amount of sulphur and iron present in the coal seam, and the character of the roof. Under certain conditions, where the strata above the coal are of a basic nature, surcharging the percolating waters with basic constituents, which tend to neutralize the acid in the mine drainage, the drainage may for a time be slightly alkaline, but this condition is unusual. In the examination of the drainage from 160 mines operating in the Lower Measures of coal in Somerset and Cambria Counties in Western Pennsylvania, the writer found only four from which the drainage was slightly alkaline. Table II gives analyses of mine water collected during this investigation which may be considered as typical for mine drainage.

Coal in situ has no effect on the quality of the water in the streams on which it outcrops. It is the impurities, such as iron and sulphur, in the coal coming in contact with air and water after mining is started that produce chemical changes which result in the formation of acid drainage. This condition does not change after the mine is worked out and abandoned, but in general the drainage continues to be acid for several years, and comparable in quality to that from active mines. Before mining is started, the coal in place and undisturbed acts as a barrier to the percolating waters above and prevents the water and air from coming in contact with the impurities, and for this reason a virgin field of coal has no detrimental effect upon the purity of the streams.

TABLE II—ANALYSES OF COAL MINE DRAINAGE

	Grains per U.S. Gallon Miller*	Central†
Total solids	266.01	146.42
Probable incrustants	190.15	96.26
Suspended matter	7.29	10.50
Iron oxide, (Fe_2O_3)	21.56	9.22
Aluminum oxide (Al_2O_3)	12.90	3.36
Calcium oxide (CaO)	30.55	16.47
Magnesium oxide (MgO)	9.05	9.77
Sulphuric anhydride (SO_4)	129.40	72.74
Sulphuric anhydride acid sulphate (SO_3)	20.82	10.04
Free sulphuric acid (H_2SO_4)	34.42	23.62
Chlorine (Cl)	0.70	0.47
Treatment required:	**Pounds per 1000 Gal.**	
Lime (90 per cent CaO)	7.30	5.31
Soda ash (95 per cent Na_2CO_3)	19.52	13.01

* Sample collected Aug. 10, 1920, at Miller Shaft, near Portage, Cambria County, Pa. Flow about 334,000 gal. per day at the time sample was taken.

† Sample collected Aug. 13, 1920, at Central Pumping Station, near Johnstown, Pa., Flow about 3,365,000 gal. per day at the time sample was taken.

Both analyses were made by E. C. Trax, chief chemist, McKeesport Water Co., McKeesport, Pa

Many other samples were collected in Cambria and Somerset Counties. Those given above represent what might be termed average analyses of mine drainage in the bituminous region.

The beds of streams receiving mine drainage soon become coated with a typical deposit. This deposit protects the rocks of the stream-bed from the action of the acid in the mine drainage, from which it could otherwise obtain neutralizing elements. Therefore, although a stream in its course may become clarified to a certain extent, the acid is largely retained, and the water is not improved in its course, except in so far as the acid content may be reduced by the neutralizing effect of surface waters from tributary streams not contaminated with mine drainage.

Water Supplies for Domestic Use—The presence of mine drainage in a water supply renders it unfit for domestic use. It is impossible to maintain plumbing fixtures on account of the action of the acid. This trouble becomes specially apparent after the water is heated and deposits of ferric oxide are formed on the pipes. This produces a water totally unfit for laundry purposes.

Water Supplies for Industrial Use—Sulphuric acid in the strength encountered in mine drainage attacks iron and steel very readily, as evidenced by the rapid deterioration of pumps and pipe lines receiving such drainage. When water impregnated with sulphuric acid and its products, known as sulphates, is used for boiler purposes, it produces disastrous effects within the boiler, causing pitting rather than extending uniformly over the surface of the metal. The result of pitting is to produce failure much sooner than if the thickness were uniformly decreased. Locomotive boilers are operated under very high temperatures and pressures, thus making the pitting effect much more pronounced than in stationary boilers.

Disposal of Mine Drainage by Dilution—It is probably safe to say that so long as the flow of the stream is 120 times the flow of mine drainage no difficulty will be encountered in allowing the drainage from mines to enter the streams under the ordinary conditions that obtain in the bituminous coal region.

Treatment of Mine Drainage—The treatment of mine drainage so as to render it harmless to streams is in its infancy. The plant of the H. C. Frick Coke Co. at its Calumet mine in Mount Pleasant Township, Westmoreland County, Pa., marks one of the first attempts to treat mine water. (For details of this plant see article by L. D. Tracey, *Coal Age*, July 1, 1920, p. 12.)

Briefly, limestone pulverized to pass through a 200-mesh screen is thoroughly mixed with the mine water by means of a baffled tank and baffled flume, then settled for about four hours in a second tank, then drawn off over weirs and passed to a storage basin. It is estimated that about ¾ ton of powdered limestone is used to remove one ton of ferric oxide. If the free sulphuric acid is neutralized, the ferric sulphate is changed to ferric hydrate and calcium sulphate, but the latter is in solution and thus ferric hydrate remains as a byproduct. This material, the settling tank sludge (about 75 per cent water), is reduced to a dry yellow powder by splashing the sludge against a steam heated drum. During the year 1920, the Calumet mine plant produced about six tons of ferric hydrate per day. This material is in demand by companies manufacturing artificial gas for the purpose of removing the hydrogen sulphide present in the gas. It is also one of the chief ingredients of a number of paints. The Calumet plant is still in the experi[mental] stage but may be characterized as an encou[raging] step towards an ideal plant.

Suggested Simple Treatment of Mine Dra[inage]—The writer believes that a simple plant could be [con]structed to treat mine water so that the effluent co[uld] be discharged into a stream without seriously i[mpair]ing the water for water supply purposes. A sketch [of] such a plant is shown by Fig. 3.

Let us consider that it is required to provi[de] for the treatment of mine drainage from an area of [200] acres of workings. From Fig. 2 is seen that f[rom] such an area we may expect an average flow of abou[t] 400,000 gal. per day. It has been proved from experiments in the process of sedimentation that very little advantage is gained by retaining the water in the tank for a longer period than two hours. With a flow of 400,000 gal. per day, a tank of the cross-sectional area shown by Fig. 3 and a length of 72 ft. will meet the requirements in this case.

In view of the fact that ordinary limestone contains only about 48 per cent of lime, whereas the calcined stone carries about 76 per cent, it is the opinion of the writer that it would be advisable to use calcium hydroxide (slaked lime) in place of the pulverized limestone, thus avoiding the construction of a pulverizer and mechanical conveyors, and getting more direct contact of the neutralizing element and the mine water. To treat 400,000 gal. per day of ordinary mine drainage would probably not require more than 400 lb. of quick-lime.

The sludge from the settling tank, if it cannot be disposed of on the lines suggested by the experiments at Calumet mine, could be deposited on drying beds, so constructed as to prevent the leachings from contaminating the stream. When dried, the material would be removed to a dry place and covered with earth.

Excluding Mine Drainage from Water Supplies—To the writer's knowledge, no laws have yet been enacted in the states where coal mining is prosecuted to protect water supplies from mine drainage. Moreover, such decisions as have been rendered have been in favor of the coal companies. There remain as alternative protective measures the construction of conduits to intercept mine drainage and the acquisition of mineral rights. Intercepting the mine drainage and discharging it below the reservoir of a given water supply has two very serious drawbacks: (1) If the drainage is carried in pipe lines it would require the use of pipes not affected by acid drainage. Terra cotta pipes would resist the acid but the writer has examined several drainage lines built of this material, and in every case great trouble was encountered by the deposits on the walls of the pipe. While wet, this deposit is very hard and can scarcely be picked off with a knife. When it becomes dry it can easily be reduced to a fine powder by rubbing it between the fingers. To prevent such deposits the mine water would first have to be collected in settling basins. This would make such drainage lines very expensive. (2) The amount of water cut off from use at the reservoir would present a very serious problem in dry weather.

Control of Mineral Rights—The only safe plan in the light of present conditions, and when no relief is offered by law, is for the water companies to gain control

of the minerals on the watersheds where they contemplate the construction of reservoirs for purposes of water supply. This would not only be a great burden to the public on account of the necessary increase in the rates for water service, but it would also be equally as great a blow to the domestic and industrial world by reason of the elimination of large areas of coal from which indispensable fuel must be obtained.

Sealing Abandoned Mines—As has been said, the drainage from abandoned mines is as injurious as that from active mines. The writer tested the drainage from mines that had been abandoned for as long a period as fifteen years and found it to be highly acid.

Under the present regulations of mining coal it would be very difficult to prevent the drainage from abandoned mines from entering the streams, for the reason that the surface is generally broken to the limits of the outcrop of the coal. However, under a strict regulation that no coal shall be disturbed beyond the limits of a 20-ft. cover, and that no openings shall be allowed to be made other than are absolutely necessary for mining purposes, it is the opinion of the writer that abandoned mines could be effectually sealed.

Considering that the coal between the outcrop and the line of about 12-ft. cover is of little value, and cannot be shipped under normal conditions, the loss of coal resulting from confining the mining to a limit of 20-ft. cover would not be large compared with the benefits derived from leaving such a solid barrier to prevent the seepage from abandoned mines from entering the streams.

Suggestions for the Future—There is no hope for relief until legislation is enacted and enforced to regulate the discharge of mine drainage into the streams of such states. However, we cannot expect that any state will pass such an act until an approved and efficient method of treating mine drainage is offered. In the opinion of the writer, the Department of Sanitation in the United States Bureau of Mines is the proper authority to make an exhaustive study of treating mine drainage so that it may be discharged into streams without dangerous results. This would be a much more efficient method of procedure than to have each state make investigations.

It is very evident that the expense of treating mine water would be no hardship to the operators, as it is an axiomatic principle that the consumer must always bear the burdens incident to coal production. However, if it can be shown that the added expense would not exceed 10c. per ton of coal produced under normal prices of labor and material (and the writer feels very confident that it would not exceed this) the local water-consuming public would no doubt gladly bear this extra expense, if it could be assured that supplies of pure water could be maintained during the operation of the mines and after they are abandoned. It would be a small price to pay in comparison with the benefits received, benefits so vital to the health and happiness of the people.

To obviate the necessity of treating the mine water from abandoned mines, or at least to have the volume of such drainage reduced to a minimum, it should be unlawful to mine any coal within the area included between the outcrop and the line of 20-ft. cover.

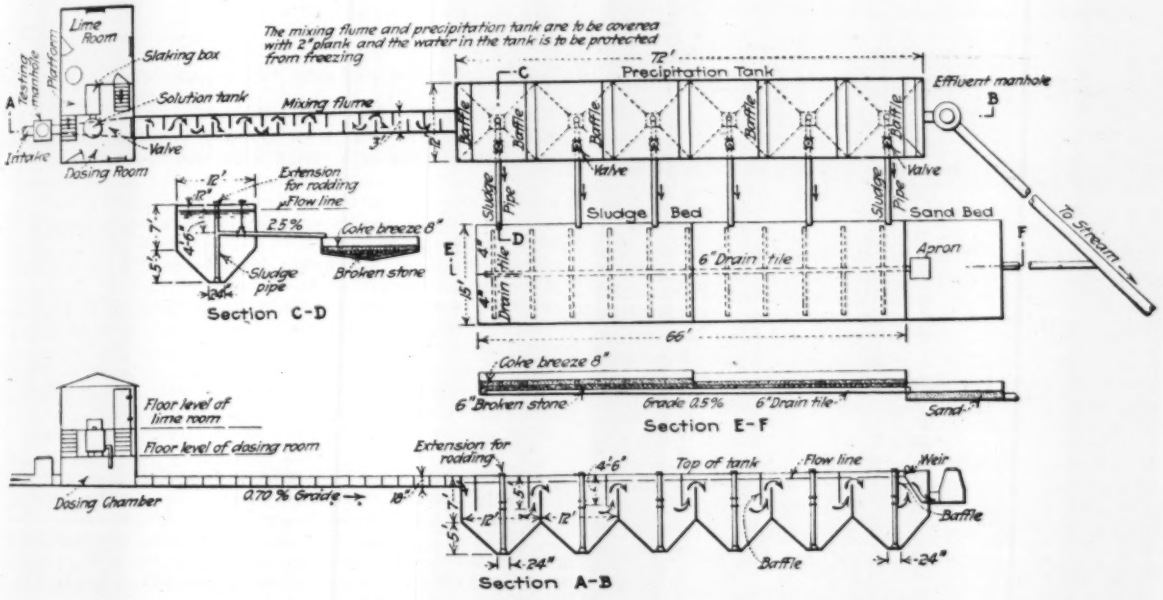


FIG. 3—SKETCH OF SUGGESTED PLANT FOR TREATING MINE DRAINAGE WITH SLAKED LIME
Designed for daily capacity of 400,000 gal. The object is to neutralize acid sufficiently so that, with stream dilution, it will not injuriously affect water supplies. The flume and tank to be covered with 2-in. plank as frost protection.

Engineers Should Control Street Traffic

According to C. Augustus Vollmer, of the Los Angeles police, traffic control should be divorced from police duty and given to engineers. Speaking before the Traffic Commission of Los Angeles, he said that traffic control has outgrown its status as part of the duty of a policeman and is now the work of expert engineers, for it has reached the point of a scientific problem involving street capacity and many other similar matters which are out of the scope of a police officer and more in the field of engineers.

Theory and Tests on Duty of Irrigation Water

Discussion of an Article on the "Economical Use of Irrigation Water Based on Tests" in *Engineering News-Record*, by Barry Dibble, B. A. Etcheverry, J. B. Lippincott, Lynn Crandall, A. Lincoln Fellows, and the authors

Determination of the actual theoretical, ideal and practical duty of irrigation water has formed the main subject for most meetings of irrigation engineers, operators and users since the Mormons started irrigation in Utah. MESSRS. CLYDE, GARDNER *and* PROFESSOR ISRAELSEN *have made a heroic attempt to bring practice and actual need into consonance by means of a formula developed from carefully observed tests at widely distributed points. To develop views on the value of the proposed methods a number of engineers were asked to comment on the article. Below are given the replies of five engineers together with answers by the authors. When understood the method seems to meet with approval, although objections as to blind use are sounded and accepted by the authors as proper.*—EDITOR.

Soil Samples a Better Guide than Formulas

BY J. B. LIPPINCOTT
Consulting Engineer, Los Angeles, Calif.

THE AUTHORS have gone into higher mathematics in order to work out the duty of water curves for different crops. Their article impresses me as an unusually complete demonstration of the manner in which the theorist is likely to attack a problem of this kind. I do not consider their mathematical demonstration of any value whatever because there are so many local conditions that enter into this problem of the growing of plants. For instance, adjacent to our coast where we have frequent fogs, we raise crops without any irrigation at all, and these same crops, fifty miles inland, would scarcely germinate. Again, the soil conditions completely modify the amounts of water required for all our crops.

In addition to my engineering work I am interested in three farms. We watch the condition of the leaves on the plants closely and when they begin showing any wilt we know that it is time to serve them with additional water. We also have soil augers and take samples of the soil at different depths from time to time and are guided largely by our observations of the soil samples. I have a superintendent who is a university graduate in citrus culture and these are the methods that he uses. They strike me as being unusually practical and far superior to those proposed in your article.

* * *

Farmers' Handicaps Must Not be Discounted

BY LYNN CRANDALL
Water Commissioner for Big Lost River, Mackay, Idaho

THIS PAPER is a commendable attempt to find a rational basis for solving the perplexing problem of determining the proper "duty of water" under certain specified conditions.

In applying it to large projects, however, the results of experimerts on small plots of ground, judgment and discretion must be used. On the experimental lots the ground is well prepared, adequate help is available, soil moisture conditions are under control so that water can be quickly applied to the entire plot when so needed, and the average experimenter is usually — unconsciously, perhaps — interested in establishing the fact that large yields can be secured with small or moderate amounts of water. The average irrigation farmer, on the other hand, labors under many handicaps. He has to start irrigating his fields before the soil moisture has been fully utilized by the crops as otherwise the crops will suffer before irrigation is completed; he suffers at times from interruptions and fluctuations in the water supply. His available help is often insufficient to see that the water is changed at proper intervals, especially during the night; his ground is often poorly prepared on account of lack of resources, and in many instances he is a tenant with but slight interest in making any permanent improvements. The net result of these various factors is that in practical operation a greater amount of water must be supplied to the farmers than the amount determined from the irrigation of experimental plots.

If all irrigation projects were settled by ideal farmers, men of practical ability, energy and good judgment, who owned their places free from debt, then indeed might the experimental *y-w* curves be approached in actual practice. The "expectancy curve" of such an event ever happening, however, is one the determination of whose co-ordinates defies mathematical analysis.

Even when allowance has been made for the amount of water to be delivered to the average farmer to irrigate some particular crop, in addition to the amount determined from experimental plots, the first step only has been taken in the solution of the problem of determining the acreage that can be irrigated from some stream of measured runoff. The water requirements for crops like alfalfa are nearly twice as great as those for grain, so that obviously the proportion of the project to be devoted to particular crops will have an important bearing on the water requirements for the project as a whole. It often happens during the early years of settlement of an irrigation project that large areas are devoted to grain. Later the development of the daily industry, for example, leads to the seeding of considerable areas of pasture, alfalfa, etc., requiring greater quantities of water than the grain which they displaced on the land.

The losses in the canal system from the point of river diversion to the settler's land must be estimated and in the case of large canal systems these losses may consume nearly as much water as the net amount used by the plants. When the requirements at the point of river diversion are thus determined, there still remains the problem of correlating this demand with the records of available river runoff. If a sufficient supply is provided by storage or from the natural flow to supply the demand during the years of average runoff, what will the supply be during the lean or dry years, and how often will they occur? A project cannot achieve a substantial success that furnishes an adequate water supply during three out of five years, with a severe shortage during the other two years.

A large irrigation project with earth canals, where the soil conditions, crops, climate, etc., are such as result in a net duty of water of say 2.25 acre-ft. per acre, for the season, on the land, will generally require not less than 3 acre-ft. per acre delivered at the settler's headgate and from 4.5 to 5 acre-ft. per acre, or perhaps more, at the point of river diversion.

Engineers must share with the promoters the responsibility for many poorly conceived irrigation schemes—largely because of a too ready use of experimental data on "duty of water" without a full appreciation of the necessary allowances that must be made to cover the points mentioned by the writer. In studying the irrigated areas of the western United States, those sections that are prosperous, productive, with good roads and schools, with established land values and permanent and attractive homes, are invariably those which have an ample water supply, generally considerably in excess of the amounts that most irrigation engineers would consider necessary.

Some of the factors that enter into the "duty of water" question can be reduced to a mathematical basis, as has

been done by the authors; the determination of others must rest upon judgment and experience. In general, however, engineers should recognize that the results of experimental "duty of water" tests must be applied to large acreages with caution and with proper allowances, and that the successful productive, irrigated areas are using more water and will continue to use and require more water than the amounts that have been generally considered necessary by most "duty of water" investigators.

* * *

Warn Against Waterlogging, Alkali and Leaching

By B. A. Etcheverry
Department of Irrigation, University of California, Berkeley, Calif.

THE METHOD of solving the problem is interesting and is based on the application of economic principles to the results obtained from tests. It is, however, important that the results of these tests be not given undue weight and that the different values obtained for the economic number of acre-inches applied per acre for the different conditions and crops be considered only as illustrative and not the proper values to use in practice. The importance of this is obvious when it is realized that the economic depths derived from these tests are generally considerably in excess of what is required under reasonably good practice and in excess of the quantities which have caused large areas of irrigated lands to be damaged or rendered worthless by waterlogging and accumulation of alkali.

The limited water supply in many parts of our arid states is not sufficient to serve all of the best lands. The economic use of water is therefore of primary importance. It is unfortunate that much of the water used for irrigation is controlled in a large measure by vested rights or sold on the acreage basis independently of the quantity of water used. It is only where water is costly or charged for in accordance with the quantity of water used that there is an incentive for the careful use of water.

Results obtained from tests may be very misleading unless the conditions affecting the use of water are fully considered and the limitations appreciated. Many of the tests have been made on small tracts where the water table is deep down and where the surplus water added to the land passes down beyond the reach of plant roots and is carried away by natural underdrainage without raising the water table. These tests often give larger yields than are generally obtained over a large area of irrigated land. The larger yields and the relatively free subsoil drainage naturally cause a greater use of water than that required in practice.

In a large area of irrigated lands the deep percolation loss or surplus irrigation water gradually causes a rise in the water table. A condition of equilibrium is obtained when the surplus water is balanced by the underground drainage and the increased soil moisture evaporation due to the high water table. Unfortunately in many cases this condition of equilibrium is only reached when the water table is so near the surface that much waterlogging and accumulation of alkali result.

A large part of the water applied on the test tracts may be surplus irrigation water, passing down beyond the reach of plant roots. For instance, the experiments made at Davis, Calif., show that with 36-in. depth of water a yield of more than 9 tons of alfalfa was obtained, while the Utah experiments show a yield of about 4¾ tons per acre with 48-in. depth of irrigation water. Evidently the Utah tests show a less efficient use of water with probably considerable deep percolatory loss. The yield of over 9 tons per acre on the Davis tract is much larger than that generally obtained in practice. On large irrigated areas in the San Joaquin Valley the yield of alfalfa is not over 5 tons per acre. This is in part due to the effect on the root system of a high and fluctuating water table, which results from more water being delivered to the areas than the quantity necessary to produce the crops.

The yield water curve for wheat from the Utah experiments shows about 46 bushels of wheat with zero acre-in. of water applied and about 57 bushels with about 36 acre-in. of water applied. Evidently the larger part of the 36 acre-in. applied was lost by deep percolation. With this quantity of water added to a large area of irrigated lands, unless unusual natural underground drainage existed, waterlogging would soon occur.

The economic depth of irrigation water to use for the different crops for the conditions and values assumed by the authors of the paper may be justifiable if it will not produce damages of waterlogging, accumulation of alkali and leaching of fertility from the higher lands. If these damages do result, the cost of these damages or of drainage works to prevent waterlogging should be an additional factor to consider in arriving at the economic depth.

* * *

Amount Applied in Single Irrigation a Factor

By Barry Dibble
Project Manager, Minidoka Project, U. S. Reclamation Service, American Falls, Idaho

AN EXCELLENT work has been accomplished at Logan, Utah, in determining the effect that modification in the application of water has upon the production of various crops. From the standpoint of the irrigation engineer this study is important as showing the factors that affect the water supply which it is economical to provide in a given case. In much of the arid West there is more good land than there is water available with which to irrigate it. Nearly all future irrigation projects will require a heavy initial investment to get water onto the land. Promotors are tempted to spread the water thinly over a large acreage to make the cost per acre low. When the farmer's turn comes he wants a liberal supply of water so that he may get the maximum crop per acre and avoid part of the work necessary in distributing water efficiently. Somewhere between the two extremes lies the economic mean which the authors are endeavoring to find.

When it comes to the practical application of experiments and formulas for determining the duty of water, there is a factor not considered in this paper which is of great importance; that is, the amount of water which is applied to the soil in a single irrigation. It is well established that the amount of water which the soil will retain within reach of the plant roots is very limited. If the application exceeds this amount, as is usually the case in current irrigation practice, the excess water percolates beyond the depth of the plant roots and ultimately reaches the ground water plane. The soil depth penetrated by the roots, of course, varies greatly with different plants.

Don Bark, in some of his experiments in Idaho, built a concrete cistern 6 ft. under the ground surface in which he caught the water that passed out of the test bed. S. T. Harding by other methods reached similar results on different soils. Both showed that twenty-four hours after irrigation the upper 6 ft. of soil retained an amount of available water equal to only 4 cu.in. per square inch of ground surface, even though a depth of 12 in. or more had been applied. At the end of twenty-four hours the water, particularly on the coarser soils, was still passing rather rapidly downward. In irrigating a field it is common practice to over-irrigate the part near the headgate in order to get sufficient water to the lower end of the field. It is possible for the farmer with some extra expense, care and labor largely to avoid these losses and thus reduce the quantity of water applied to the soil.

The question of the proper duty of water has frequently been before the courts in the West and its determination has often rested upon the testimony of the "practical farmer." With the development of irrigation and the increase in the acreage of lands that must be irrigated from the available water supply, it is becoming more and more important to adopt operating and farming methods which will result in greater economy in the use of water. Because of the great number of variables there is room for much analytical study such as Professor Irsaelsen and his assistants are giving this subject.

Decision as to Constants Difficult

By A. Lincoln Fellows
Senior Irrigation Engineer, U. S. Department of Agriculture, Denver, Colo.

THE ARTICLE is a notable step in the direction of a more definite knowledge regarding the most profitable use of water n irrigation. It is particularly valuable in calling the attention of irrigation engineers and managers to the fact that the most profitable use of water in irrigation may depend upon the application of a smaller, sometimes materially smaller, amount of water than is required for a maximum crop production, a fact that is too often ignored. This fact has been previously commented upon by various writers but this is the first deliberate attempt that I know of to present a method that may be used to insure the greatest profits in irrigated agriculture, and I have already made some use of it in trying to arrive at the proper amounts to be used in estimating the probable duty of water in certain regions.

The greatest difficulty lies in the fact that it is hard to decide upon the values for the constants of the formulas that will be of general or even local application, since the cost figures and also the values of agricultural products vary so greatly from year to year that any conclusions reached must be used with considerable caution. It is believed, also, that the discussion might be simplified to advantage by using profit-water curves based on the governing conditions of cases 1, 2 and 3, eliminating the calculus involved, which, though comparatively simple, nevertheless conveys an unnecessary impression of abstruseness to many practicing engineers.

Furthermore, the use of water studies involving calculations with respect to large areas is complicated by the fact that the water will be applied not to a single variety of crop, as in the authors' illustrations, but to a great variety of lands and crops giving different yields with respect to both quantity and value, and requiring different amounts of water. For these reasons I fear that the application of the formulas will in general be limited to more or less academic discussions of the duty of water rather than to determinations of the amounts to be provided by canal systems or for the irrigation of specific tracts of land. Nevertheless, I am of the opinion that the publication of the article will prove to be beneficial to irrigation. The same method has already been used to determine the proper amount of fertilizer to apply to land.

The comments made herein result from discussions held with a number of irrigation engineers and constitute, therefore, a consensus of opinion rather than my own individual thoughts. I am under especial obligations to Julian Hinds, engineer, U. S. Reclamation Service, for a letter regarding the article, some of which letter is quoted herein.

* * *

Authors' Replies to Comments and Criticisms

By Willard Gardner
Associate Physicist, Utah Agricultural College, Logan, Utah

FROM THE nature of Mr. Lippincott's premises it would be difficult to make a reply that would be satisfactory to him. He should note, however, that the determination of the empirical y-w curve is an important feature of the proposed method and that the authors have not overlooked the importance of local conditions. A careful record of measured quantities of water applied in accordance with the observations noted in his last paragraph, together with careful records of crop yields, is just the kind of information we would desire for the establishment of this function. By all means, it should not be overlooked that notwithstanding all apparent demand for water as indicated by the condition of the plant and the condition of the soil, it is frequently impossible to apply even a fractional part of the additional water needed without a very careful method of handling a limited supply.

It might be wisely contended that a precise analytical treatment of approximate and uncertain experimental magnitudes is unscientific. Does it not seem probable, however, that the experimental methods of modern science are adequate for the determination of such functions as the representative y-w function for a given locality with a fair degree of precision, parameters involving the time and also such parameters as are characteristic of sub-divisions of a given locality entering the function only implicitly through the average value?

On the other hand, an eagerness to abandon hope because of inherent difficulties in the analytical treatment is in many cases perhaps the principal obstacle in the way of the solution of some very practical problems.

The statements of Messrs. Crandall, Dibble and Etcheverry indicate that they have given the paper careful consideration and it is reassuring to note that their criticisms are constructive. We are aware of the importance of Mr. Crandall's distinction between the amount of water necessary at the farmer's headgate and the amount to be delivered from the river.

To regard the water and the land as a sort of perpetual annuity from which present and future generations must benefit is no doubt the proper point of view, and, as Mr. Etcheverry suggests, an attempt to secure a maximum profit per acre or per acre-inch for any one harvest might under certain conditions be like killing the goose for the golden eggs. To introduce the time explicitly, however, obviously increases the analytical difficulties, and experimental data available at present are wholly inadequate to determine how the time should be introduced in any given case. Even were it possible to do this, the rather subtle question may then arise, just what is the maximum for which we are seeking? Are we looking for a maximum value of the time integral or the profits function? If so what is our upper time limit? Or are we looking for a maximum value of the "present worth" of the "annuity?" In either case we must decide upon the upper limit of a definite integral. It is to be hoped, however, that methods of irrigation, coupled with methods of tillage and methods of cropping, may be adopted which will insure permanent maximum annual profits.

Concerning the "expectancy curve" mentioned by Mr. Crandall, if by careful experimentation the y-w curve is established for a given locality, from this curve we ascertain the amount of water which we would recommend and the question of primary importance is this: Can a careless farmer use economically amounts of water in excess of this amount? The immediate answer to this question is that if his farm is of the average type for the locality he can do so only by using wasteful methods for the water which he first applies and careful methods for that which he applies subsequently. The careful farmer will use the amount recommended as a matter of choice because he will discover himself that this is the proper amount if he is not disposed to adopt it because of our recommendation. If his farm is of the average type he does not need to worry about a y-w curve of his own, his principal concern being to ascertain the appropriate amount of water he should use for his own benefit. Of course if the water costs him nothing he is concerned only with securing a maximum yield.

It is perhaps unnecessary to discuss these various questions that arise in further detail at this time. If we succeed in stimulating an interest in the subject we shall regard it well worth while and shall of course have no objection to any appropriate modification of the proposed method of attack.

* * *

By O. W. Israelsen
Professor of Irrigation and Drainage, Utah Agricultural College, Logan, Utah

IT IS gratifying to note the substantially correct interpretation of the purpose of the paper. Mr. Crandall has properly emphasized the need for judgment and discretion in the application of our methods of interpretation. Likewise Professor Etcheverry urges the need for caution, not so much in the use of any methods of analysis, as in the assurance that the experimental tests are dependable and applicable to the particular conditions confronting the engineer in a given case. It is noteworthy that Messrs.

Crandall and Etcheverry urge caution for precisely opposite reasons: First, that the tests being conducted under ideal conditions indicate a need for amounts of water far below actual necessities and second, that because of the free drainage under many test plats, the experiments frequently show a necessity for amounts of water far in excess of those most economical for large projects with a water table near the soil surface. Since the purpose of our paper is to present a rational basis for the interpretation and application of the results of thoroughly dependable duty-of-water experiments we consider it inadvisable here further to consider the difference presented in the comments of Messrs. Crandall and Etcheverry. Suffice it to say that in our opinion a few of the many duty-of-water tests heretofore conducted are dependable if properly interpreted, and that it is yet feasible in many western valleys by further experiments to establish the *y-w* or duty-of-water curve with sufficient precision to be of real value, despite the admittedly large number of independently variable influencing factors. To one of the variable factors, namely, the water capacity of soil and the amount of water applied in a single irrigation, Mr. Dibble gives particular attention. We agree that this factor is vital in the correct experimental establishment of the *y-w* curve, and we have treated it in some detail in a different publication. (Israelsen, Orson W. and West, Frank L., 1922—Water-Holding Capacity of Irrigated Soils. Utah Agr. Exp. Sta., Bul. 183, pp. 1-24.)

We regret that our paper failed to make clear to Mr. Lippincott even the elements of its purpose. His statement that "the authors have gone into higher mathematics in order to work out the duty of water curves for different crops" is manifestly erroneous. We do not claim that our analysis looking toward the establishment of rational methods of interpretation of duty-of-water experiments is of any value in determining the time to irrigate. On the contrary we agree that an examination of the leaves and of the moisture conditions of the soil by means of borings with a soil auger are very good methods of determining when water is needed. For this purpose we use these methods on our own farms.

In order to use its limited water supply most economically the West must clearly have vastly more information. We agree with Mr. Crandall in the assertion that "engineers must share with the promoters the responsibility for many poorly conceived irrigation schemes" not so much because of a too ready use of experimental data as because of un unintelligent use of these data. Moreover, courts, water commissions, state engineers and other public organizations confronted with the problem of adjudicating water rights have had presented to them widely different interpretations of experimental data by authoritative men whose motives are genuine. These differences have resulted in part from the necessity of forming opinions upon the basis of insufficient analysis of the rather perplexing problem. It therefore seems reasonable to believe that a comprehensive analysis of the results of dependable duty-of-water experiments, in which consideration is given to the cost of the water and the land, the labor cost of producing the crop together with its sale value for a period of years and other closely related practical questions, may reduce to some extent the difficulty of approaching a correct solution of the problem.

Rapid Transit Railway at Sydney, Australia

Active work on the combined city underground and elevated line of the New South Wales Government Railways at Sydney, Australia, is outlined in the report of the Railway Commissioners for the year ending June 30, 1923. Part of the underground lines is cut-and-cover work, built in a trench made with an American dragline excavator and steam shovels. The remainder consists of double-track tunnels and twin tunnels, all with concrete lining. Part of the elevated line will be a six-track structure. Extensive works are required for stations and for connections with existing lines.

Again the English Channel Tunnel

A STATEMENT as to the project on a 27-mile English-French submarine tunnel under the Straits of Dover has been issued recently by Sir Percy Tempest, chief engineer of the tunnel company and also general manager of the Southern Ry., whose lines would connect with the tunnel. This project, of many years' standing, is kept alive by its promoters, although the British government persists in refusing to grant the necessary authority, largely for national and strategic reasons. According to the present statement, the material to be encountered for the entire distance is very favorable, being a deep bed of chalk marl, or chalk infiltrated with clay. That this material does not swell on exposure and is impervious is shown by the trial heading built in 1880-1881 and extending about a mile under the sea. With the boring machine designed for this work, and used experimentally, a heading 12 ft. in diameter can be driven at the rate of 120 ft. per day, and two machines started at opposite ends should meet in less than three years. It is proposed to complete this pilot tunnel or heading and then its enlargement to full section could be started at various points, so that the time for the completion of the concrete-lined tunnel is estimated at 4½ years. Instead of the usual mucking operations, the excavated material would be mixed with water to form a grout and then pumped to the surface. With present prices the cost is estimated at $145,000,000. The annual revenue, based on existing traffic, would be more than 5 per cent of the cost, but it is expected that the tunnel communication would cause a great increase in traffic. A suggestion that a concrete caisson might be sunk in mid-channel for a working shaft with two additional headings is rejected by the engineer, partly on account of the extreme difficulty of sinking such a caisson in an open sea, subject to heavy storms, and with the danger of being struck by ships. Furthermore, with permeable strata and a hydrostatic pressure of 5½ tons per square foot there would be danger of water breaking through the seal at the bottom of the caisson and pouring through into the shaft.

Railway Relinquishes Water Supply Business

A water system operated by the Boston & Maine R.R. to serve its own water stations and a municipality has been sold to the latter, but under a contract which insures a supply to the railroad. This company had an investment of about $15,000 in the Woodsville Aqueduct Co., which furnished water to the railroad at Woodsville and Wells River, N. H., and also to the village of Woodsville. The situation is stated as follows in the annual report of the Boston & Maine R.R.:

"Some dissatisfaction existed in the village because the water, although well suited for railroad purposes, was thought not to be suited for drinking water, and it was felt that it would be wise for the railroad to go out of the business of furnishing water and electricity. At the same time, it was necessary that the railroad should be assured of a sufficient supply of both at this point. The Aqueduct Company was formed in 1885 and had developed into a property of considerable value. Negotiations had been going on for some time, and early in 1922 the Woodsville Fire District voted to purchase the water-works system and plant of the Woodsville Aqueduct Co. The district further voted to contract to furnish the Boston & Maine R.R. with water and electricity for a term of twenty years,

Engineering Literature

A MONTHLY REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Relativity for Laymen

REVIEWED BY GEORGE PAASWELL

Specialist in Mathematical Engineering Problems, New York City

FOUR LECTURES ON RELATIVITY AND SPACE—By Charles Proteus Steinmetz, A.M., Ph.D., Past-President, American Institute of Electrical Engineers. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. 126; 32 line cuts and halftones on cards in pocket. $2.

Dr. Steinmetz has evidently joined the throng of those, who, having accepted Relativity, become fired with a holy zeal to make all laymen converts to the theory. It is a very ambitious task to render a popular account of Relativity and it is surprising to note how convincing many of the explanations appear in the course of the lectures. However, it is only just to state that the author meets far greater success in demonstrating the significance of relativity than in exhibiting its plausibility.

There has arisen a classic method of explaining the new doctrine, founded upon its historical development. Starting with the failure of the Michaelson-Morley experiment to demonstrate motion with respect to the ether, the unique postulate of the shortening of time and space measures made its appearance. Then came the theorem of special relativity, that it is impossible to determine uniform motion with respect to the ether. There followed the fundamental law that the velocity of light is the same to all observers regardless of their reference system of co-ordinates. This is true merely because its converse would permit determination of motion with respect to the ether.

In contrast the author starts with two simple premises: (1) All phenomena of space, time and motion are relative, and (2) All laws of nature are universal. On their face, these two statements are easily acceptable, but, as a matter of fact, there is not enough in the two to premise the relativity theory upon, and the fundamental statement following these two premises, that the velocity of light is everywhere constant, appears rather as a contradiction than as a consequence of the premises. Relativity is founded upon an entirely novel conception of physical law and little is gained by attempting to reconcile Newtonian mechanics or our slightly ramified conceptions of space with the new theory. That the velocity of light is constant, regardless of the reference frame used, is a unique assumption not met with anywhere in the domain of physical law heretofore, and it seems unfair to the reader to attempt to slip such a law by him without, at least, pointing out such uniqueness.

It is all very well to give the usual examples of the bullet and the moving train and the observer fixed upon the earth but one should frankly admit that these simple analogies do not lead to an acceptable explanation of relativity. Such relative motion has always been accepted and completely understood. However, the author has really given a brilliant demonstration of the equivalence hypothesis—the equivalence of the gravitational field with a simple transformation of acceleration axes—and his examples there are exceedingly well chosen. As a general conclusion, drawn by the reviewer after having read a number of attempts to explain in a popular sense what relativity is, it seems far better to cling to a simple mathematical statement of the space of relativity and then to convince the reader that, due to the soundness of the mathematical demonstrations and to the experimental confirmation of the fundamental premise, the conclusions of relativity are correct.

Lectures 3 and 4, on Space Properties, are of exceeding interest and the geometry and other characteristics of the space described should certainly arouse sufficient interest in the reader to make him want to learn more of non-Euclidean geometry. As one notes the almost universal acceptance of the demonstration of the curvature of the high space by simply stepping up the formulas from two dimensions onward, there is an uneasy feeling that the mathematicians are justly irritated in the forced analogy between the space geodesics of Euclidean geometry and the properties of the world lines in the new space. In the long run it may be that the analogy will confuse rather than illuminate the properties of these new space "invariants."

On the whole one feels that the new book is a very stimulating contribution to the so-called popular treatises on Relativity and it is hoped that when the reader has finished it he will take up some of the more serious texts—Eddington's first report, Weyl (as translated into Engish), Silberstein, Cunningham, Robb and others.

Co-operation Instead of Conflict

INDUSTRIAL DEMOCRACY: A Plan for Its Achievement—By Glenn E. Plumb and William G. Roylance. New York: B. W. Huebsch, Inc. Cloth; 6x8 in.; pp. 359; frontispiece portrait of senior author. $2.

Some two years ago the late Glenn E. Plumb attracted country-wide attention by his plan for the nationalization of our railways. The plan was heartily approved by the various railway brotherhoods and received a warm welcome from organized labor generally and more or less endorsement by advocates of public ownership of all utility monopolies. Opposition, as was to be expected, came from representatives of the railways and of capital as well as from that part of the general public which was ready to protest that government operation of the railways, express, telegraph and telephone services during the war had been unsatisfactory.

Full of confidence in the underlying principles of his plan for the railways, Mr. Plumb went on with an elaboration of the application of those principles to all industry. In this he had the co-operation of W. G. Roylance. The result is this book on Industrial Democracy, the text of which, as the foreword states, "was in a finished state at the time of Mr. Plumb's death." The foreword adds: "The form and content of the book, arrangement of material and general philosophy resulted from earnest collaboration. The known familiarity of Mr. Roylance with the problems of agriculture, public finance, banking, currency, credit, and their relation to industrialism gives authentic value to their treatment."

Regardless of one's opinion as to the causes and remedies for the industrial conflicts, cycles of prosperity and depression, this book deserves wide and careful reading. It is no wild-eyed or wild-minded vision of a mere dreamer; nor of a man bent on bringing all capital and industry within the control of any one class, large or small. Instead, it is a carefully reasoned argument for applying what the author conceives to be the fundamental principles of democracy, as set forth in the Constitution of the United States, to the production and distribution of all goods and the conduct of all services required to satisfy human needs, including, particularly, financing these enterprises.

The substitution of a thoroughly democratic co-operation of all contributing in any way through labor, managerial ability, or accumulated capital in money or other form for the present endless conflicts between the respective contributors, each for his own gain, regardless of the interests of the rest, is the basic idea of the book. Organized industry is now conducted for profit rather than for production to meet human needs, the book holds. Moreover, the control of industry, it is maintained, is vested largely and almost overwhelmingly and increasingly in capital which operates from without instead of from within the industry and without any specific knowledge of the industries controlled. The mass of the producers has no part whatever in the control of industry, except as gained through strikes, actual or threatened.

Profits, the book holds, are abstracted from industry to pyramid capital on which the whole effort is to earn more and more profit. If a larger and due part of these profits went to the mass of producers, the book holds, then their consuming capacity would be increased and with it the market for commodities. Instead, the argument runs, capital demands absorb the purchasing power of the mass of producers so that from time to time goods pile up, wages are cut or employees let go, and the purchasing power of the mass of producers so curtailed results in the stagnation of industry.

Under Mr. Plumb's conception of industrial democracy, co-operation in production would be secured, not by abolishing private corporations and attempting any sort of communism, but through corporations organized on a thoroughly democratic basis. Under this plan every one engaged in production would share in both the control and the profits of industry in direct proportion to what each individual and each class contribute. The consuming public would be a partner in benefit but not in management. The returns to money capital would be some established percentage of the amount of money contributed to the enterprise. Voting for corporate management control would be proportioned upon the dividends paid to capital on the one hand and on the other upon the salaries and the wages paid to management and to labor. A part of the profits would go to the reduction of capital loans and a part into the business. Eventually outside capital loans might all be paid off. When profits exceeded all charges, including an established rate of return on the investment, prices for goods produced would be cut, thus making the consuming public a partner in the enterprise. By such means, the authors believe, the great waste in industry through the struggle between the present conflicting interests would be eliminated and economic and industrial efficiency obtained, together with individual and social justice.

The book contains a plan for operating the coal industry and plans for the benefit of agriculture, for market, for credit, for foreign trade—the latter also to be based on the principles of industrial democracy.

As might be expected from a book of propaganda, the book contains many dicta and allegations with little or no supporting data or documentary references. A wide reading of the book is to be hoped for, as it is full of food for thought. Whatever the fate of the plan so well presented may be, many of its underlying principles and supporting arguments are incontrovertible and are bound to be accepted in some part as the years go by.

Railway Maintenance

REVIEWED BY S. B. MCCONNELL
District Engineer, Canadian Pacific Ry., North Bay, Ont.

PRACTICAL RAILWAY MAINTENANCE—By Charles Weiss, C.E. New York and London: McGraw-Hill Book Co. Cloth; 6 x 9 in.; pp. 343; many line cuts. $3.50.

The author appears to have attempted to produce a volume suitable both for the student and the man of experience in railway maintenance. Although a great deal of information is presented much of it is of doubtful value to the man of experience. As for the student, while the book might be interesting it would, in some instances, prove misleading inasmuch as it evidently cites practices which, although suitable under certain conditions would be considered of questionable merit under others. A guide to beginners, who cannot be expected to have the knowledge at their disposal to enable them to discriminate between the conditions under which the rules laid down should or should not be followed, should state, where rules are not universally suitable or even suitable throughout this continent, under what conditions—as of climate or traffic—they should apply.

To cover railway maintenance in a manner to be of material value to those outside a limited area, the author's viewpoint should be based not only on a wide and varied personal experience, but also on a study of the experience of others under conditions beyond his own experience. In the case of this book one is forced to the conclusion that the viewpoint of the author is limited and the book of value only to those confronted with the same conditions. The following extract from page 11 is an example to support this conclusion: "Use the fall for final surfacing, lining, tie renewals and similar work, leaving the gaging for winter." This program may and no doubt does meet the requirements where the author has received his experience, but where winter means continuous frozen ground from November to May, as well as a heavy covering of snow throughout the most of this period, it would obviously be bad practice to leave the tie renewals until fall, as there would then be no opportunity to do the final surfacing before the freeze up; and as for the gaging, if left for the winter, there would be the added expense of removing the snow when every hour of labor available is required for shimming, bracing and other work resulting from the frost action. Under such conditions shimming could not be carried out as suggested on page 70.

The value or correctness of many other statements is open to question, but a single illustration will serve to show that this work is not based on a broad knowledge of railway maintenance.

English and the Engineer

ENGLISH FOR ENGINEERS—By S. A. Harbarger, Dept. of English, Ohio State University, Member, Committee on English, Society for the Promotion of Engineering Education. New York: McGraw-Hill Book Co., Inc. Cloth; 5 x 8 in.; pp. 266. $2.

The importance of the correct use of English in the success of the engineer is clearly set forth in this book, directed mainly to the undergraduate engineer and written purposely as a textbook. Properly studied, it should be most valuable to the embryo engineer, particularly if he takes to heart the author's true words: "A man's language is taken by most to indicate not only his literacy but also his background, the grade of society in which he has placed himself, his tastes, his aspirations, his diligence and his appreciation."

The letter, the wire communication, the explanation —of a design, a process, a piece of construction—the abstract, the report, and also conversation are the means whereby the engineer may sell his professional knowledge and ideas. The aim of this book is to develop in engineering students, who frequently pay too little attention to English while in college and regret it when they come to practical work, the ability to have something definite to say and to say it concisely and clearly.

While there are no exercises in the book, specifically for classroom study in engineering schools, there are plenty of references to sources for such material. The volume is also well supplied with examples and models for all the forms of writing discussed, the models being taken from books and from the leading technical journals of the day. Emphasis is laid throughout the book on the value of correct expression, even in the paper and envelope transmitting a letter, and on the importance of self-analysis to be sure that one has something the recipient will want to hear before he sets himself to letter or engineering report. article or editorial.

One feature that is interesting is the stress laid on oral discussion in society meetings, undergraduate as well as later professional. Too little attention is usually given in English work to oral expression, and to insist on attention at and participation in engineering society meetings as a means of developing proficiency in speaking while not a novel idea is one well worth emphasizing to the undergraduate.

The Writing of Briefs

BRIEF DRAWING—By Ralph Curtis Ringwalt, A.B., LL.B.; Member of the New York Bar. New York and London: Longmans, Green & Co. Cloth; 6x8 in.; pp. 214. $1.50.

In the logical marshaling of the main facts bearing on an engineering project, the engineer may often profitably follow the same general theory and practice as is followed by the lawyer in preparing a brief. This little book presents in small compass the fundamentals of brief drawing, as they appear to a lawyer who has both taught and practiced law. Emphasis is laid on one essential which every novice, whether in law or in engineering, must realize if he is to succeed: A brief, argument, or report must be drawn to convince the class of person to whom it is addressed.

After defining a brief, the author considers library research, reading and note taking, argumentation, the audience, and various phases of proof and evidence. He then analyzes brief drawing, including among other things the various classes of paragraphs, the introduction, the argument, the conclusion. A model brief closes the book.

The volume should be suggestive to pr[illegible]rs in engineering schools and useful both to s[illegible]ts of engineering and to many a practicing engin[illegible]

Kent's Handbook Largely Rewri[illegible]

KENT'S MECHANICAL ENGINEERS' HANDBOO[illegible] late William Kent, M.E., Sc.D. Tenth Edition, Re[illegible]n, by Robert Thurston Kent, M.E., editor-in-chief, and s[illegible] f spe-cialists. London: Chapman & Hall, Ltd. New [illegible] John Wiley & Sons. 4½x7 in.; pp. 1,247; line cuts. Flexi[illegible]nding. $6.00 net; leather, $7.00 net.

The tenth edition of Kent's well-known Handbook has been largely rewritten. It contains much new text and many new tables. There is considerable new information on heat and heat insulation, fuels and combustion, air compressors and condensing equipment, power transmission and electrical engineering; considerable information in regard to railroad engineering with special reference to train resistance and locomotive design; and much new material in the section on machine design. The sections on fans and blowers, hydraulic turbines, pumps and pumping engines, steam engines and steam turbines, oil engines and gas producers, hoisting and conveying equipment, refrigeration and ice-making, and heating and ventilation have been entirely rewritten. New sections include gas turbines, automotive vehicles, aeronautics, fusion welding and cutting, malleable casting, reinforced concrete, and safety engineering.

PUBLICATIONS RECEIVED

ILLUSTRATIONS and some text have been added to the second edition of Special Assessments, a Means of Financing Municipal Improvements, by the Committee on Sources of Revenue, National Municipal League, 261 Broadway, New York City. (Technical Pamphlet No. 15; pp. 21; 25c. each or $15 a hundred.)

THE INCREASING ACTIVITIES of state health departments in the field of applied sanitation, particularly in the South, is illustrated by a 45-p. pamphlet on The Operation of Water Filtration Plants of the Mechnical Gravity Type prepared by the Bureau of Engineering and Inspection of the North Carolina Board of Health (Raleigh). Half of the space is occupied by plain directions for filter operation, plant records, etc., and half by a description of chemical and physical tests for general filter, chlorine, bacteria and hydrogen-ion control.

THREE CONTRIBUTIONS to the June *Monthly Weather Review* (issued in September) will appeal to engineers: (1) Robert E. Horton, consulting hydraulic engineer, Voorheesville, N. Y., fills 15 pp. with a discussion of Rainfall Interpolation, accompanied by tables and diagrams; (2) Prof. Peter Philipovitch Gorbatcher, Rostov on Don, Russia, has some 4 pp. Concerning the Relation Between the Duration, Intensity, and the Periodicity of Rainfall; and there is a short paper on City Planning and the Prevailing Winds, by Clarence J. Root, meteorologist, Weather Bureau Office, Springfield, Ill.

A NATIONAL PLAN STUDY BRIEF, consisting of brief text and a number of striking diagram-maps of the United States, has been reprinted and is available in the form of a 24-p. Supplement to *Landscape Architect* (Cambridge, Mass.) for July, 1923. The author is Warren H. Manning, landscape and city planning consultant, Boston, Mass. The text deals chiefly with the natural resources and other opportunities afforded by the United States and the need of a national plan for their fullest and wisest utilization. The map-diagrams show our river and mountain systems; crop regions; original and present forest areas; rainfall totals by districts, with arid, semi-arid, irrigable and humid areas; lands improved and unimproved; soil in relation to

agriculture; factory centers; coal and lignite and also peat deposits; minimum potential water power by states; railroads; commercial and recreation areas and connecting ways; rural population per square mile, and national and state reservations—all of which may be characterized as a grand preliminary survey.

TRIBUTES TO THE LATE DR. HERMANN M. BIGGS, for several years health commissioner of New York State, are found in *Health News* for July, recently issued. Among the contributors outside of his one-time associates in the New York City and State health services are Prof. C.-E. A. Winslow, Yale University; Dr. Hugh S. Cumming, Surgeon-General, U.S.P.H.S.; Dr. Charles V. Chapin, superintendent of health, Providence, R. I.; Prof. George C. Whipple, Harvard University, and Dr. E. C. Levy, president, A.P.H.A. (Albany, N. Y.: State Department of Health.)

USEFUL INFORMATION designed "chiefly for the practical miner or small operator" is given in Timbering of Metal Mines, by E. A. Holbrook, Richard V. Ageton, and Harry E. Tufft. One or more methods for each timbering operation are given. (Washington D. C.; Bureau of Mines; one copy free.)

PUBLIC HEALTH BULLETIN No. 135 on Railroad Malaria Surveys, 1922, the Missouri Pacific Railroad, by A. W. Fuchs, associate sanitary engineer, U. S. Public Health Service, reviews malaria presence among employees and the effect of malaria on operating costs and railroad revenue, and presents a malaria control program. (Washington, D. C.; Public Health Service; one copy free.)

HIGHWAY INSTRUCTION IN ELEMENTARY SCHOOLS, designed to give also instruction in science, geography, civics, history and literature, is outlined in a 42-p. illustrated pamphlet, Main Streets of the Nation, by Florence C. Fox, specialist in educational systems, Bureau of Education (Washington, D. C.).

THE TWENTY-FIFTH SPECIAL REPORT of the National Industrial Conference Board (10 E. 39th St., New York City), on Engineering Education and American Industry, has sections on (1) the need for trained leadership in industry; (2) the educational problem and (3) the responsibility of industry. Under (2) there are discussed: the engineering school, tendencies in engineering courses, suggestions from industrialists, training in fundamentals, and selection and classification of students.

UNDER THE TITLE "Some Compressive Tests of Hollow-Tile Wall," by H. L. Whittemore and B. D. Hathcock, the Bureau of Standards (Washington, D.C.) has issued Technologic Paper No. 338, describing strength tests on tile walls 6, 8, and 12 in. thick, and 4 ft. long by 12 ft. high. It contains some excellent detailed information on this type of construction.

THE AMERICAN WELDING MILL CO., of Middletown, Ohio, has issued a little book entitled "River Shipping in Industry," which is a compilation of historical and river shipping data on the Ohio River and its tributaries. It is frankly in advocacy of waterways transportation, but it seems to be valuable as a directory of the Ohio River district.

Foreign Papers and Reports

THE ADDITIONAL WATER SUPPLY for Johannesburg and five other "magisterial districts" in the Transvaal, South Africa, comprising a total population of about 600,000, is described in a Souvenir of the Opening of the Vaal River Scheme—an illustrated pamphlet written chiefly by W. Ingham, chief engineer, Rand Water Board, Johannesburg. The works described include an impounding reservoir of over 16 billion U. S. gallons capacity, a low-lift pumping plant, settling basins, mechanical filters with a capacity of 6.4 m.g.d. (Imp.), a clear-water reservoir and high-service pumps delivering water under a 480-ft. head through a 26½-mile force main. After the water thus delivered has been mixed with an underground supply in a reservoir it is again pumped, part under an 820- and part under an 1,100-ft. head, a further distance of 14 miles to high-service reservoirs.

ANOTHER OCCASIONAL DESCRIPTION of the Works of the Birmingham, Tame and Rea District Drainage Board, by John D. Watson, chief engineer (Birmingham, England), has appeared. Altogether three plants treat the sewage of a little over a million people, chiefly from Birmingham. The main sewage-works, dealing with the sewage from a population of about 900,000, is and long has been one of the most interesting plants in the world. It includes detritus, storm-water, sedimentation, balancing, silt, separate sludge digestion, and final sedimentation tanks, together with bacteria beds (percolating filters, which receive the clarified sewage) and sludge drying beds. Besides describing all three of the plants Mr. Watson devotes a few pages to two activated-sludge units and a percolating filter, each of 12,000 U. S. gal. daily capacity. One of the activated-sludge plants depends on compressed air and the other on mechanical agitation for activation, and each treats tank-settled sewage. The tests thus far made indicate, Mr. Watson says in effect, that either method of activation may be used successfully on Birmingham sewage; that tank liquor is better than crude sewage for activation; that one hour of "efficient flocculation" removes 60 per cent of "the impurity" and all "objectionable smell" from the tank effluent and "produces a liquor which may be oxidized at more than double the present rate on a percolating filter."

New Books and Revised Editions

BLUEPRINT READING: For the Machine Shop and Related Trades—By Joseph Brahdy, B.S., C.E., Brooklyn Vocational School, and Brooklyn Evening Technical and Trade School. New York: D. Van Nostrand Co. Cloth; 11 x 8 in.; pp. 18; 134 halftones and line cuts on blue. $2.50.

ELASTICITY AND STRENGTH OF MATERIALS USED IN ENGINEERING CONSTRUCTION: Section III, Theory of Torsion in Shafting, and Double Bending of Plates—By C. A. P. Turner, Consulting Engineer, M.Am.Soc.M.E., M.A.S.T.M., M.S.P.E.E., M.Am.Soc.C.E. Minneapolis, Minn.: Published by the Author. Cloth; 6 x 9 in.; pp. 122; 132 line cuts. $5.

THE ELEMENTARY PRINCIPLES OF LIGHTING AND PHOTOMETRY—By John W. T. Walsh, M.A. (Oxon), M.Sc. (London), A.M.I.E.E., F. Inst. P., Member of International Illumination Committee of Great Britain, General Secretary of International Commission on Illumination, Senior Assistant in Photometric Division of the National Physical Laboratory; with a Foreword by Sir J. E. Petavel, K.B.E., F.R.S., D.Sc. Cloth; 6 x 9 in.; 85 diagrams by G. H. Lewis. $4.50.

FIRE LOSSES: LOCOMOTIVE SPARKS—By L. W. Wallace, M.Am.Soc.M.E., M.Soc. Industrial Engs.; Executive Secretary, American Engineering Council of the Federated American Engineering Societies; former Professor, Railway Mechanical Engineer, Purdue University. New York: Barr-Erhardt Press, Inc. Flexible; 6 x 9 in.; pp. 203; 111 halftones and line cuts. $3.

Gives the result of five years' study of the relation of locomotive sparks to fires occurring along railroad rights-of-way. Covers the fundamentals of locomotive construction and operation from the standpoint of spark control, the effect of various types of spark-arresters, the distribution and character of sparks, and their ability to ignite combustible material.

HYDRAULICS APPLIED TO SEWER DESIGN—By G. S. Coleman, D.Sc. Eng. (London), Assoc. M.Inst.C.E., Associate Member of the Institution of Municipal and County Engineers, Senior Lecturer in Municipal and Sanitary Engineering in the Municipal College of Technology, Manchester, England, and Assistant Lecturer in the same subjects in the Victoria University of Manchester. London: Crosby Lockwood and Son. New York: D. Van Nostrand Co. Cloth; 5½ x 8½ in.; pp. 150; 70 line cuts. $4.

MEMOIRS: With a Full Account of the Great Malaria Problem and Its Solution—By Ronald Ross. New York: E. P. Dutton & Co. Cloth; 6 x 9 in.; 11 plates. $9.

MOVABLE AND LONG-SPAN STEEL BRIDGES—Compiled by a Staff of Specialists: Editors-in-Chief, George A. Hool, S.B., Consulting Engineer, Professor of Structural Engineering, University of Wisconsin; and W. S. Kinne, B.S., Professor of Structural Engineering, University of Wisconsin. New York: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; many halftones and line cuts. $5.

SOUTHERN YELLOW PINE: A Manual of Standard Wood Construction. Ninth Edition. New Orleans, La.: Southern Pine Association. Flexible; 5x7 in.; pp. 186; line cuts. $1.50.

Material added in this edition "includes timber working stresses based on recent extensive tests, new matter affecting the design of latticed wood trusses, and the calculation of nailed and bolted timber construction." Municipal and state building codes have been omitted because of the difficulty of keeping these revised to date, to keep the Manual of convenient size, and because the Southern Pine Association looks forward to a national building code. The volume contains many tables and diagrams and much other material of value to southern pine users.

A TEXT BOOK OF FILTRATION: Industrial Filtration and the Various Types of Filters Used—By Charles L. Bryden, E.M., B.S.; and George D. Dickey, B.S. Easton, Pa.: The Chemical Publishing Co. Cloth; 6 x 9 in.; 264 halftones and line cuts. $5.50.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Bates Road Tests and City Streets

Sir—There appeared, in *Engineering News-Record*, Sept. 6, 1923, p. 399, under the heading, "Bates Road Tests Do Not Apply to City Streets," an article by Ivan Houk, criticising the reports on the Bates test road. They have not, he said, made clear that the conclusions drawn do not apply 100 per cent to city pavements.

The Bates road tests having been made under certain conditions, we would not dream of supposing the conclusions drawn to apply to other conditions. It is the engineer's job to know the conditions he has to contend with. The conclusions drawn from one set of conditions and results must be modified before being applied to a different set of conditions.

The impression that the design of slab adopted by Illinois was intended to strengthen the edges of the pavement more than the middle, is wrong. Reports clearly state that it was intended to make them *as strong*. Whether the bulk of heavy traffic runs at the side or on the middle little affects the design. Remembering that it was the last straw which broke the camel's back, we design to prevent, as far as possible, a broken pavement, by making the slab uniform in strength throughout—strong enough to take care of stray loads as well as the more frequent ones. This condition is obtained, in our state roads, by thickening the edges until they are as strong as the middle.

One method suggested, in the Bates road reports, to protect the edges of pavement was to use curbs. These are used with city pavements, and although constructed for other reasons, they still may have this further use. But we cannot guarantee that heavy traffic will not run to the side of the street, and we would feel inclined to make the sides, as well as the middle of the street, strong enough to carry it.

There are however many features in city streets which call for more particular design. Slabs of uniform thickness are weakest at the corners and in city streets we may at times encounter corners which unquestionably will be subjected to maximum loads and maximum stresses. For example when a street-car track runs out a spur line, forming a terminus, there will be several pavement corners in the middle of the street.

The support of the subgrade in city streets would normally be better than in state roads, but the Bates road tests showed that owing to temperature changes causing the slab to warp, the pavement lifted clear of the subgrade. The amount of warping varies considerably with different types of pavement. How much this takes place in city streets should be ascertained by tests; it may be responsible for failures on a well prepared subgrade. In state highways, it is an important factor in design.

In short, the subject of city paving was not specifically within the scope of the Bates road tests, and the reports were not intended to discuss or compass it. Each pavement must be designed to meet its own peculiar requirements, and however much these individual requirements may vary, there will still be many properties in common to all pavements, and the designer of city streets may still benefit from the tests conducted at the Bates experimental road.

HADDON C. ADAMS,
Assistant Highway Engineer, Illinois State Highway Commission.

Springfield, Ill.,
Oct. 1, 1923.

Further Discussion of Low-Head P[illegible]

Sir—I was, naturally, much interested in [illegible]er by M. C. Steuber appearing in your issue of Sep[illegible] p. 486 which I take occasion to answer because certa[illegible]ements by Mr. Steuber are misleading and should be cl[illegible]up both to him and to your readers. I wish it to be und[illegible]od that my statements herein are made only in the spir[illegible]friendly criticism and are meant to bring out the facts [illegible]y.

It is to be noted that in my article in the Aug[illegible]ssue, p. 230, I drew comparison with other pumps of th[illegible]me size as my model, operating at equal capacities a[illegible]t equal heads. To those who understand the subject it [illegible]fair to draw comparisons without taking account of all [illegible]ese factors. However as Mr. Steuber has drawn a d[illegible]t comparison I shall take him up without any apology for size and make a direct comparison myself, as a very important feature was overlooked.

A very little study discloses the fact that the Malde pump described never gave a discharge velocity of over 5.1 sec.-ft. (usually called spouting velocity) and only gave this at 1-ft. lift and at 650 r.p.m., which I judge means a peripheral speed of 45.5 ft. per sec. of the impeller. The velocity head of the water only once reached .403.

The Malde pump showed 40 per cent at 3-ft. lift with a spouting velocity of 3.16 sec.-ft. whereas the rotary flow for the same conditions of lift and efficiency gave a spouting velocity of 7.6 sec.-ft. or 2.4 times as much as the Malde. At 5-ft. lift the Malde shows 39 per cent efficiency with a spouting velocity of only 3.5 sec.-ft., whereas the rotary flow shows 36 per cent with a spouting velocity of 9.7 sec.-ft. This is 2.77 times great as the Malde. At 6-ft. lift the rotary flow shows 39 per cent efficiency with a discharge spouting velocity of 9.2 sec.-ft., whereas the Malde with 38 per cent efficiency shows only 3.25 sec.-ft. Again, the rotary flow, for equal conditions of efficiency and head, gives a rate of discharge (spouting velocity) 2.84 times as great as the Malde.

This proves conclusively the superiority of the rotary flow without reference to the difference in size which I will now take up.

From a comparison of the friction losses in 4-in. and 16-in. pipe, using the figures for 100-ft. lengths in a standard table, it would appear that a 4-in. casing with a spouting velocity of 9.5 sec.-ft. should lose 31.6 times as much head due to friction as a 16-in. casing of equal length. Due allowance should be made for this in making comparisons.

A 16-in. pump at a 6-ft. lift and a spouting velocity less than 6 sec.-ft. should give not less than 80 per cent. It has been done. If the rotary flow under this low condition of capacity did not do as well I would be greatly disappointed.

The fault in the Malde pump, unfortunately, is inherent in the design; and, short of radical changes in this, it cannot be expected to give much higher efficiencies, especially if the rate of discharge is increased, in which case it would be expected to fall off.

With regard to the test curves, I will say for Mr. Steuber's benefit that though only two tests were shown, these are typical of twenty run under widely varying conditons.

The discharge characteritics were predicted, and so were the efficiencies and high speed and the horsepower curves and furnished no surprise on test. What did furnish a little surprise was the ability of the pump to operate with a pipe velocity of only 1.5 ft. per sec. on the higher lifts at a very high peripheral speed without cavitation.

While the Malde was not run at over 45.5 ft. per sec. peripheral speed, one incomplete test was run at 72 ft. per sec. peripheral speed with the rotary flow with an increased discharge but no other difference from other tests. This test was not finished because the writer lost his nerve at the sight of a 650 r.p.m. motor running 2,500 r.p.m.

I believe that the above covers all of Mr. Steuber's questions and I thank him for his interest in this subject.

EUGENE F. DELÉRY,
Design Engineer

New Orleans, La.,
Sept. 30, 1923.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Am. Soc. C. E. Board Acts on Davis' Dismissal

Special Committee Report Accepted Recommending Protest Letter Be Sent Dr. Work

Engineering News-Record Staff Report

Preceding the fall meeting of the American Society of Civil Engineers at Richmond, Va., Oct. 17-20, twenty-six of the twenty-eight members of the Board of Direction of that society on Oct. 16 took decisive action in the matter of the dismissal of A. P. Davis from the Reclamation Service. The Board accepted the report of a special committee composed of John F. Stevens and George S. Webster, recommending that a letter be sent to Secretary of the Interior Work protesting against his contention that an engineer is not competent to conduct administrative positions, and citing examples wherein engineers have become famous through their executive abilities. The letter will also demand from Secretary Work specific citations of the failure of engineers in reclamation work. It will probably also demand congressional action looking toward the assurance that an engineer will be responsible for government irrigation.

The Board of Direction may attempt, it was brought out, to bring about Congressional action looking toward the appointment of a many-sided technical commission to investigate and report upon the whole question of the development of the St. Lawrence River for power and navigation uses.

EARTHQUAKE COMMITTEE FORMED

A committee to investigate the earthquake in Japan was appointed, to be headed by the following California members of the society: J. D. Galloway as chairman, C. H. Snyder, and C. B. Wing. It is probable that Japanese members will be added.

Definite action regarding the formation and activities of the proposed committee on cement was put over until the January meeting of the society. The report of the licensing committee was received but has not yet been adopted or made public. However, without indorsing the principles of registration, the Board recommended that in view of the many state laws the profession should indorse a uniform law, and the standing committee was authorized to prepare such a law.

New procedure decided upon for the professional conduct committee will be for the secretary of the society to prepare an unbiased brief in the matter of any professional dereliction brought to the attention of the society. The committee will then study the case and report confidentially to the Board, which shall then decide whether or not the case is to be made public.

Prizes for the past year were awarded as follows: Norman medal, D. B. Steinman, for paper on "Locomotive Loading for Railway Bridges"; James J. R. Croes medal, James F. Sanborn, for paper on "Engineering Geology of the Catskill Water Supply" (this was a joint paper written by Dr. C. P. Berkey and Mr. Sanborn, but as Dr. Berkey is not a member of the society, the award was made to Mr. Sanborn); Thomas Fitch Rowland prize, S. W. Peek, Jr., for paper on "High-Voltage Power Transmission"; James Laurie prize, R. W. Gausman and C. M. Madden, for paper on "Experiments with Models of the Gilboa Dam and Spillway"; Arthur M. Wellington prize (first award, the prize having been established in 1921 by *Engineering News-Record*), J. P. Newell, for paper on "Analysis of Cost of Freight Service, Grand Trunk Railway Co. of Canada"; Collingwood prize for juniors, Jacob Fels, for paper on "Accurate Experimental Determination of the Lateral Earth Pressure Together with a Resume of Previous Experiments."

Two honorary members were elected to the society, though neither has made formal acceptance of the election. They are Onward Bates and Desmond FitzGerald, both past presidents of the society.

Coming meetings of the society were arranged as follows:

1924: spring meeting, Atlanta, Ga.; summer meeting, Pasadena, Calif.; fall meeting, Detroit, Mich.

1925: spring meeting, Cincinnati, Ohio; summer meeting, Salt Lake City, Utah; and fall meeting Montreal, Que.

Flood Cuts Embankment of Oklahoma Reservoir

A flood of greater volume than the one which swept down the North Canadian River in Oklahoma last June and overtopped the dam of the reservoir of Oklahoma City has again overtopped the dam and embankments and has cut a channel 350 ft. wide through the embankment at the west side of the reservoir.

The Oklahoma City reservoir is located in the valley of the North Canadian River about eleven miles above the city. (For a description of the dam and of the flood of June, 1923, see *Engineering News-Record*, March 4, 1920, p. 478 and Aug. 23, 1923, p. 292.) The reservoir is formed by a reinforced-concrete dam and spillway and an earth fill dam with a concrete core-wall across the main channels of the river. A bypass channel and emergency spillways were provided to take care of floods. Beyond the west end of the earth fill dam is a low embankment protected along part of its length by a gunite mat. According to a report from C. E. Bretz, superintendent of the city waterworks department the crest of the flood was 27 in. above the top of the dam when the river started cutting through the embankment at the west end of the dam. A futile attempt was made to save the embankment by the use of sand bags.

The flood followed a rainfall of nearly 6 in. which started on Oct. 12. The embankment failed at 12:25 a.m. Oct. 16, 1923.

Army Camp Builders Demur to Fraud Indictments

Defendants Ask Cases Be Thrown Out Contending Indictments Charge No Crime

A demurrer to the indictments of Benedict Crowell, W. A. Starrett, C. W. Lundoff, Morton C. Tuttle, Clair Foster, James A. Mears and John H. McGibbons, charging conspiracy to defraud the government in connection with building army cantonments, was argued before Judge Hoehling, of the District of Columbia Supreme Court, during the first two weeks in October. The principal counsel for Mr. Crowell and his associates were Frank J. Hogan, of Washington, and Col. Henry L. Stimson, formerly Secretary of War under the Taft Administration. The government was represented by ex-Congressman McCullough of Ohio and W. T. Chantland, both of whom have been connected with the Department of Justice in the preparation of the indictments, and by U. S. District Attorney Peyton Gordon.

ASK DISMISSAL

The defendants combined in asking that the indictment be dismissed on the ground that it charged no crime, but based an allegation of fraud solely on the opinion of the present Department of Justice regarding the wisdom of a governmental policy; that is, the making of cost-plus contracts for the construction of the army training camps. Counsel defied the Department of Justice to indict Woodrow Wilson and Newton T. Baker, ex-President and ex-Secretary of War respectively, although quite obviously the crime charged against the defendants was equally chargeable against the heads of the administration. Col. Stimson, although a Republican, said that the indictment was obviously an attempt on the part of the present administration to transform a political difference of opinion into a criminal prosecution. He insisted that were the indictment of Mr. Crowell and his associates upheld no President would ever be free to exercise his function as Commander-in-Chief of the Army and Navy. If confronted with the emergency of war and the imperative necessity of prompt action, the executive would be compelled to appeal to Congress for specific authority for his every important act, to await debates and enactment, or else to act with the knowledge that a criminal indictment would hang over his head.

Ex-Congressman McCullough said that the crime consisted in the deceit of the responsible officers of the government, misrepresentation of material facts, resort to coercion, and finally the control and domination of the whole construction activities of the government during the war. The waste and delay due to the methods adopted might have been vitally contended had the nation been forced to exert its every effort to win the war.

Ford Muscle Shoals Offer Still Stands

Appeal to Farmers in Attack on Sale of Gorgas Steam Plant—Weeks Replies

In an attack on the Secretary of War for the sale of the Gorgas steam plant to the Alabama Power Co., Henry Ford stated that his offer to buy the Muscle Shoals development still stands. He accused the Secretary of War of favoring interests who opposed the use of Muscle Shoals for the manufacture of fertilizer when he sold the steam plant. He said in part as follows:

"Long ago Mr. Weeks matured in his mind the plan to break up Muscle Shoals and dispose of it piecemeal. When he sold the steam plant at Gorgas he pulled the first stitch in unraveling the greatest prospect ever held out to the American farmer and manufacturer.

"The next steps are so plain that a child can see them. It only remains to sell the gigantic nitrate plant No. 1, and then nitrate plant No. 2, and finally the Wilson Dam itself, and that is the end of Muscle Shoals as a possible demonstration of the cheapness with which power and fertilizer can be produced.

* * *

"The Ford Motor Co. never has needed Muscle Shoals. We have water-power sufficient for all our purposes. The only thing I could do at Muscle Shoals which I am not able to do elsewhere would be to make fertilizer for the farmer. And that is the sole reason why John W. Weeks and scores of corporation lawyers have exerted their cunning to prevent me. The same influences that prevented a vote in the House last Spring are responsible for the sale of the Gorgas plant to prevent a vote on Gorgas."

In repeating his offer to buy the whole development Mr. Ford made a statement regarding the use of the power which he has not made before, i.e., that power would be sold to the surrounding community. He said:

"My offer is still before Congress. I shall not withdraw it. There is nothing whatever for me to explain. There is nothing that John W. Weeks can explain, though he should talk from now until he leaves public life, but I want to say this: If I get Muscle Shoals we shall run power lines 200 miles in every direction from Muscle Shoals. We have been working and have learned how to send power long distances without losses by leakage. I say this now for the benefit of the international financiers, who, with the Alabama Power Company, have Muscle Shoals almost hopelessly in their grasp."

Secretary Weeks Replies

In reply to Mr. Ford the Secretary of War said:

"Muscle Shoals was a development for nitrate purposes in the war, which included the construction of a large dam on the Tennessee River, and the construction of two air-fixing nitrate plants, with large quarries, and as an adjunct to these plants, in order to supply power ending the completion of the water power dam, a steam plant was erected ninety miles away on the Warrior River, known as the Gorgas plant.

"The total expenditure on these properties was about $102,000,000 of which less than $5,000,000 was spent upon this isolated and temporary steam plant. The steam plant was erected on the property of the Alabama Power Company, which reserved title to the land on agreed conditions which gave to them the right to purchase the Gorgas steam plant.

"The proposals made by Mr. Ford for the purchase of this entire equipment involved the payment by him of $5,000,000 for the entire plant, including the above isolated and temporary steam plant. They also involved many other conditions with regard to the completion of the water power, etc. No disposal of government property can rightfully be made by any administrative officer without the approval of Congress, and I, as the responsible official in this matter, referred Mr. Ford's offer to Congress, which has so far not acted upon it.

"In the meantime the Alabama Power Company, under its rights in the old contract, notified the government that the lands must be vacated on or before Oct. 15 this year. They offered to pay $3,500,000 for this comparatively small item of the whole equipment. The government had an option to accept this offer, which was the highest made, or to salvage this plant as second-hand machinery, and from which they could not have realized more than $1,000,000. On the other hand, it must be borne in mind that for this single item in the entire equipment the government has secured $3,500,000 as against the $5,000,000 offered by Mr. Ford for the entire plant and equipment.

"At the time of the sale, in a desire not to disturb the *status quo*, the administration stated to Mr. Ford that this amount could be credited on his original offer of $5,000,000 if it was so wished.

"Mr. Ford's declared purpose in purchasing the Muscle Shoals is the manufacture of nitrates for fertilization purposes. I have never opposed Mr. Ford's securing the use of this water power or any other equipment we have, provided he is able to give such assurance of its being devoted to this particular purpose as will satisfy Congress and properly protect the public interest. That he could ever economically make nitrates by the use of steam power is denied by every expert adviser.

"The fact that he says his offer is still open would seem to indicate that he does not regard the Gorgas steam plant as necessary to him in the carrying out of his plan to purchase and develop Muscle Shoals water power."

Texas Plans Water-Works Course

A short course of instruction for water-works operators and engineers will be given at Waco, Texas, Jan. 21-26, 1924, covering waste water, water control, boiler room economy, filter plant operation, geology of underground waters and legal responsibilities. The course, of which this is the sixth year, is given under the auspices of the Texas Water Works Association, the Southwest Water Works Association, the Texas State Board of Health, the University of Texas, and Baylor University. Dr. W. T. Gooch, of the last named school, is director of the course.

Frederick L. Cranford Nominated to Head A.G.C.

Resolutions opposing "outside" inspection of work, declaring against extension of public ownership of utilities, opposing changes in the Transportation Act and endorsing the objects of the National Transportation Institute, and appointment of a committee to formulate a safety policy with the National Safety Council to be reported to the next annual convention, were among outstanding accomplishments of the quarterly meeting of the Executive Board of the Associated General Contractors of America at St. Louis, Oct. 4, 5 and 6.

Frederick L. Cranford, of Frederick L. Cranford, Inc., Brooklyn, was nominated by the Board for election as president at the next annual meeting. A. S. Downey, of Seattle, Wash., one of the partners of the A. W. Quist Co., was nominated for election as vice-president at large. Other nominations to fill offices in the association, secured by referendum among the member chapters, are to be announced later.

The time and place for the next convention were referred to a committee composed of President J. W. Cowper, General Manager R. C. Marshall, Jr., H. H. Wilson, A. S. Downey, H. W. Baum, Frederick L. Cranford and Sumner Sollitt. Some date in January probably will be selected and the choice of location apparently rests between Chicago and Washington.

Tylor Field, of Cincinnati, was named to succeed Col. J. R. Wiggins, of Philadelphia, as the Association's member of the Joint Board of Jurisdictional Awards in the Building Industry, Col. Wiggins having resigned owing to pressure of private business.

The Board voted $500 to assist the work of the Committee on Seasonal Operations. This committee, organized a few weeks ago at Atlantic City, will hold a meeting in Washington, early in November, at the Department of Commerce.

Connecticut to Spend $15,000,000 on Roads in Next Two Years

Close to $15,000,000 will be available during the next two years to carry on the work of the Connecticut State Highway Department, according to an estimate made public recently by the Department. This sum includes direct appropriations from the state and fees which the motor vehicle department receives from registrations, licenses and fines, in addition to the state tax on gasoline. The law requires that all fees from the motor vehicle department be used for the reconstruction and maintenance of trunk line highways.

The amount appropriated by the General Assembly for the highway department for the current two-year fiscal period aggregates $4,200,000. The remaining $10,000,000 it is estimated, will be received through the motor vehicle department.

Heretofore, receipts from the gasoline tax have been turned into the State Treasury direct by the motor vehicle department, but the recent session of the General Assembly, however, directed that this money be devoted exclusively to the betterment of the state's roads. It is estimated that the gasoline tax will produce $2,000,000 in revenue during the next two years.

Work's Friends Justify Davis' Removal

Again Charge Evils of Reclamation to Engineering Control—"Business Administration" Needed

A new flare-up in the controversy over the removal of A. P. Davis, as Director of the Reclamation Service, has followed the publication of articles in the Washington *Herald* attacking the Secretary of the Interior for his course in that connection, and in particular revealing the fact that on Aug. 17 an executive order was signed by President Coolidge only a day or two after he came to Washington as president exempting Director David Davis from the regulations of the Civil Service Act. This order was signed in opposition to the recommendation of the Civil Service Commission and was kept secret until the *Herald* uncovered it.

This has had the effect of stimulating friends of Secretary Work to take a more active stand in his defense. In substance this is what they contend:

"The full responsibility of making reclamation a decided success rests upon the Secretary of the Interior, a situation very distinct from that of a technical bureau having an organic act of its own. Secretary Work had been advised from so many quarters and from such reliable sources that the agricultural and business problems of the service were not being met, that he was convinced a radical change in policy had to be put into immediate effect if the service were to be saved from collapse. He had abundant proof that most of the projects were in a bad way. He realized that Director Davis could not be in full sympathy and could not give the maximum of co-operation in putting into effect policies substantially different from his own. Moreover Secretary Work had learned that a substantial number of those on projects had been antagonized to the point by Director Davis where all hope was gone of inducing them to pool together with him.

Employment of Engineers

"In his zeal to show the capacity of the engineering professions, Director Davis had carried the employment of engineers to a ridiculous extreme. Every important post in the service was held by an engineer as well as many of the minor positions. Even the ditch-riders were engineers. The business problems and the solution of the intricate questions of a non-engineering character long had been neglected. The reclamation projects had reached a point where they were experiencing the full effect of that neglect.

"There was no intention on the part of Secretary Work, however, to disparage the engineering work that had been done, under Director Davis' direction. He was particularly anxious that reclamation continue to have the advantage of Mr. Davis' engineering ability and knowledge of its engineering problems. For that reason, he tendered him the position of consulting engineer.

"When the matter of change of policy was taken up with Director Davis by Secretary Work, the entire conversation was an amicable one. Mr. Davis even remarked that there would be less trouble getting rid of him than was the case with Dr. Newell. A second conference took place over the form the resignation should take. Secretary Work had objected to the featuring of the fact that the resignation was tendered at his request. He felt if they were to continue to work hand-in-hand in the interest of the service, a better way of phrasing the letter could be devised. This conversation apparently was on the same friendly basis as the former one, but shortly thereafter he seemed to have developed a brainstorm which led to the final stormy interview with Secretary Work.

"The engineering end of reclamation work is not being neglected. F. E. Weymouth, whose ability is universally admitted, now is chief engineer in fact as well as in name. There will be no interference with his free exercise of authority over engineering matters.

"It is no more necessary to have an engineer in charge of all reclamation activities than it is necessary to have a surveyor as the Commissioner of the General Land Office. The chief activity of the Bureau of Indian Affairs is the conduct of schools, yet it is not regarded as essential that only school teachers be eligible to the post of commissioner.

"The much discussed executive order of Aug. 17 is simply a presidential appointment to harmonize the appointment of D. W. Davis with the appointments of his predecessors. The activities of the National Civil Service Reform League smacks of first aid for the Democratic Party. All of its representatives who have called on Dr. Work have admitted affiliation with that party. A. P. Davis was not killed. He committed suicide."

Latin-American Road Engineers May Visit U. S.

Before calling the Pan-American Road Congress, authorized at the Santiago meeting of the Pan American Union, it would be desirable, in the opinion of some of those interested in the matter, to bring to the United States a road building engineer from each of the Latin-American countries. This was developed at a conference at the Department of Commerce October 5, attended by Assistant Secretary of Commerce Drake; Director General Rowe of the Pan American Union; Secretary General Sherwell, of the Inter American High Commission; Thomas H. McDonald, Chief of the Bureau of Public Roads; Pike Johnson, president of the National Automobile Chamber of Commerce, and Eugene S. Gregg, chief of the division of Transportation and Communication, Department of Commerce.

Since the motor vehicle industry was the only outside activity represented at this conference, a further meeting is to be held early in November at which it is expected others concerned will be present.

The thought was expressed that impetus would be given the congress idea in the various countries, were their principal engineers dealing with highway matters brought to the United States and acquainted with the progress of highway work here. They then would be in a better position to organize the participation of their respective countries in a congress which would be held at a later date, probably in some Latin-American city.

Secretary Hoover Calls Super-Power Conference

The New England and Middle Atlantic States to Co-operate — Should Develop St. Lawrence Power

At a conference of the chairmen of the various public service commissions of the New England and Middle Atlantic States, and the Secretary of Commerce held in New York City on Oct. 13, the Secretary said that the conference was called for a preliminary discussion of the co-operative steps which federal and state authorities should take to promote what is called the super-power development in the New England and the Middle Atlantic States; that the conference was not conceived with the idea of putting more government into business, but to stimulate the public authorities and industries toward co-operation in the development of a great service to the public. The Secretary said that engineering science has brought us to the threshold of a new era in the development of electric power. This new stage in progress is due to the perfection of high voltage transmission over long distances and the more perfect mechanical developments in generation of power whereby we can now undertake to develop the cheaper sources of power farther afield, such as the St. Lawrence River, and the cheaper generation from coal through larger and more favorably placed generation plants.

Three Problems

In summing up his remarks Mr. Hoover said that there were three outstanding problems which called for solution before a great super-power system could be set up in the New England and Middle Atlantic States. These problems were (1) The legal relation such as the inhibitions against the import or export of power across the boundaries of certain states; (2) the engineering features such as the changes in frequencies necessary to make such a free flow of power possible; and (3) the promotion of co-operation between the federal government and the states over the development of interstate power or power on navigable streams and over the means of developing the St. Lawrence River, which power Mr. Hoover thinks should be developed and poured into the common pool.

After the delegates to the conference had expressed their general sympathy with the aims of the conference and their willingness to co-operate with Mr. Hoover, he proposed that a second conference be called in about a month or six weeks at which time the public utilities and chambers of commerce throughout the territory should be asked to send representatives. In the meantime, in order that the next conference might be in a position to take more definite action, the Secretary stated that he would, through conference with the various members, prepare a program and appoint sub-committees to handle the various questions; that his office would send out the program to the members of the conference for such additions or changes as they thought desirable in order that much of the routine might be cleared away before the conference met. Mr. Hoover hopes these conferences will arouse public interest in super-power systems.

Public Health Association Holds Annual Meeting

Fifty-Second Session Well Attended—Nine Technical Sections Convene—Dr. Park New President

Engineering News-Record Staff Report

A large attendance and a well ordered program were features of the fifty-second annual meeting of the American Public Health Association at Boston, Oct. 8-11. Besides the two general meetings on Monday and Wednesday evenings, the nine technical sections held from one to three meetings each. In general, the afternoons were left free for visits of inspection to sanitary engineering services and works in and about Boston. The Sanitary Engineering Section, for instance, devoted one afternoon to a trip to plants for the treatment of paper mill and tannery wastes on the Neponset River, and another afternoon to a visit to the old and new sewage-works of Worcester, automobiles having been provided for the party in each case.

The newly chosen president of the association is Dr. William H. Park, of the Health Department of New York City, and the first vice-president is Dr. F. H. Mahoney, health officer of Boston. The new chairman of the Sanitary Engineering Section is H. A. Whittaker, director, Division of Sanitation, Minnesota State Board of Health, Minneapolis, and the new vice-chairman is Langdon Pearse, sanitary engineer of the Sanitary District of Chicago. G. W. Simonds, Jr., director of the Bureau of Sanitary Engineering of the Florida State Board of Health, Jacksonville, Fla., continues to serve as secretary of this section.

Committee Reports—The Committee on Air, Dr. George A. Soper, New York City, chairman, secured the general approval of the section subject to availability of funds and authorization of the governing authority of the association, for the preparation of a comprehensive report, estimated to run about 130 pp., dealing with the air both inside and outside of buildings, including garbage- and sewage-works and other plants that may disseminate offensive odors. The report of the Committee on Mosquito Control, together with discussions from various viewpoints, reviewed progress of work in this field. Emphasis was laid on the need of better machinery for digging the 10-in. trenches common to meadow drainage for mosquito control. It was stated that a ditcher is needed that is self-contained and that will be able to break up the sod so that it will not be washed about over hay lands at high water. The Committee on Bathing Places, through George W. Simonds, Jr., chairman, reported that several states have already adopted the tentative standards set up by the committee. The committee strongly believes that methods of analysis suitable for potable water are not well suited for the control of bathing places, but advises for the present the continued use of the A.P.H.A. standard of water analysis.

Garbage and Refuse Disposal—M. N. Baker, chairman of the committee on garbage collection and disposal, laid stress on the unsatisfactory condition of garbage disposal, which he considered to be the least satisfactory of any of the municipal public services today. This he attributed largely to the fact that garbage and refuse disposal is not generally regarded by city authorities as an engineering matter. A paper on the Beccari system of garbage disposal was presented by J. Waldo Smith, consulting engineer, Board of Water Supply, New York City, who is also president of the American Beccari Corp. Information was presented regarding several Beccari plants in Italy (see *Engineering News-Record* of Feb. 15, p. 324). Briefly, this is a fermentation system of garbage disposal, the garbage being deposited in cells of about 25 cu.yd. capacity, four cells comprising a unit. In the colder parts of the United States it would be necessary to provide not only a cover for the cells but also a roof over the cells as a whole. A Beccari installation of two units is being installed at Scarsdale, N. Y., and will be in operation the latter part of this month. In discussing this paper, George W. Fuller remarked that he had recently seen the Beccari plant at Florence, Italy, which plant seemed to be operating satisfactorily. Mr. Fuller stated that the process seemed to him to be a most interesting development of a rotting process similar to that applied to barnyard manure. He is somewhat skeptical as to the amount of oxidation that would result from the entrance of air through the openings provided for that purpose. The refuse being treated at Florence seemed to be mixed material, including manure. Apparently the process at least for some days was due to anaerobic action. Besides taking part in this discussion, Mr. Fuller presented a paper on "European Observations on Refuse Disposal," an abstract of which will appear in a later issue.

For the Committee on Water Supply and Purification, George W. Fuller presented a general survey of the field, in the course of which he called attention to new filters or extensions to old filters under construction at Philadelphia, Baltimore, Richmond, Grand Rapids, Minneapolis, Milwaukee, Detroit, Cleveland, Buffalo, Montreal and numerous smaller cities. Because "superchlorination seems likely to come into wider use," said Mr. Fuller, "especially for unfiltered supplies and for supplies which are filtered under conditions permitting plankton growths to exert an influence on the water as it reaches the consumer, it is well to bear in mind that the excess of chlorine may be removed by reducing agents, such as sulphur dioxide, thiosulphate, etc."

Sewage Sludge Committee—The report of the sludge committee, by Langdon Pearse, Chicago, reviewed progress and practice in sludge utilization at Milwaukee, Chicago, and elsewhere. The Milwaukee Sewerage Commission reports that T. Chalkley Hatton, chief engineer, has appointed a fellow to the agricultural college of the University of Wisconsin, who is devoting his entire time to the use of sludge in agriculture. The value of activated-sludge in comparison with various mixes of commercial fertilizers is being studied on a number of different crops at various experimental farms, on golf greens, etc., in Wisconsin. The co-operation of the National Fertilizer Association in the study of this general subject has been obtained. The Sanitary District of Chicago, stated Mr. Pearse, has interested a number of agricultural experiment stations in making tests of the fertilizing value of sludge. Work is now under way on cotton in Mississippi and on garden plants at the University of Illinois. From Baltimore, it is reported by Milton J. Ruark, division engineer of sewers, that the entire sludge production for the year 1922, which was about 5,500 tons on a dry basis, was either dried by heat in a contractor's plant or on drying beds, air drying on the beds being used exclusively the latter part of the year. The farmers take away all the air dried sludge but for more than a year no charge for it has been made by the city. In co-operation with the Agricultural Experiment Station of Baltimore nine acres of land have been laid out in six sections of one-half acres each, and each section divided into six plots of one-fourth acre each, for comparative studies of liquid digested sludge, air dried sand bed sludge, commercial fertilizer, commercial fertilizer and dry sludge and manure, while as a control one plot has been given no treatment. During the year 1922 the preparation of air dried sludge cos. 66⅔c. per ton. Sludge utilization at Rochester, N. Y., and Houston, Texas, was also reported by Mr. Pearse.

A review of "Thirty Years of Sewage Treatment at Worcester, Mass.," was presented by Roy S. Lanphear, supervising chemist of the Sewer Department. Chemical precipitation has been used since March, 1890, supplemented by slow sand filters since 1893, the acreage of the latter having finally been extended to about seventy-five. Imhoff tanks and sprinkling filters are now under construction.

Under the title "Observations on the Pollution and Natural Purification of the Ohio and Illinois Rivers," W. H. Frost, surgeon, U. S. Public Health Service, Baltimore, Md., reviewed studies begun in 1913, interrupted in 1917 by the war, and again carried on during the past two years. Besides their local application the object of the studies "has been to investigate the possibility of establishing closer, more general and more fundamental correlations between the degree of pollution in streams as shown by laboratory tests and such obvious contributing factors as are readily determinable by field surveys."

Treasury Water Standards — The standards for water supply to trains and steamships in interstate commerce, commonly known as the Treasury Standards, were discussed at length by representatives of the United States Public Health Service and members of the Sanitary Engineering Section. George W. Fuller raised a question as to whether there would be taken into account, in addition to the proposed B. Coli index, all the antecedents of the supply. He suggested setting up a standard higher than the present one with the understanding or hope that it might be attained within the next ten years. He also noted that abroad standards are set up with the understanding that exceptions will be made for certain places to suit local conditions.

Speaking for the Field Survey Sub-Committee of the Public Health Service's Advisory Committee on Water Standards, Prof. George C. Whipple said that much time had been spent trying to meet the ideas of some to the

effect that a scoring system for water supply should be devised. This has been given up. The committee is now considering five classes or ratings of water supply: Excellent, good, fair, poor and bad. Professor Whipple stated that his idea is that no water supply should be approved unless a sanitary survey shows it to be satisfactory. If the supply passes the sanitary survey, then bacterial and chemical data should be considered and the supply accepted or rejected after consideration of all three classes of evidence. There should be for every supply either satisfactory means of purification or else purification should not be needed. No supply should be approved if the sanitary survey shows any one of a number of major deficiencies, including such things as interconnection with possible polluted supplies, overloaded filters or by-passes around filters.

A progress report was made for the sub-committee on Chemical and Physical Standards, the report being presented by Jack Hinman of Iowa in the absence of Edward Bartow, chairman, who holds that satisfactory supply should be clear, colorless, odorless, tasteless, have certain specified chemical limitations, particularly as to lead, zinc and magnesium. Dr. H. A. McLaughlin of the Public Health Service expressed the opinion that many of the chemical and physical standards proposed by the committee were beyond the scope of the Treasury Standards.

In the course of the discussion Harry Jordan, sanitary engineer, Indianapolis Water Co., urged that there was danger of the new standards being put so high as to embarrass many water-works plants and Abel Wolman reviewed objections along this line made by representatives of a number of water-works. Mr. Wolman's conclusions seem to be that a very considerable percentage of the water-works of this country could readily meet the proposed new standards. Dr. William H. Park of New York City expressed the belief that in the New York City supply there was present a large margin of safety—this supply being one of these that have not been complying with the existing or Treasury Standards. Dr. M. J. Rosenau of Harvard University called attention to the fact that the old chemical standards as well as the present bacterial standards are based only on index of pollution.

Dr. McLaughlin said that it is hard to get down in words any directions for correlating bacterial and field surveys, but expressed the belief that as a matter of administration there would be no difficulty in such correlation.

Pacific Highway Links Completed

Good roads enthusiasts of the state of Washington will celebrate on Oct. 23-25 at Olympia completion and official opening of the last links in a 700-mile paved highway which stretches from British Columbia to the California-Oregon state line. When California completes a 114-mile gap, the Pacific Highway will be hard-surfaced from Vancouver, B. C. to Tia Juana, Mexico, and will be the longest international paved road in the world. Officials and good roads advocates from British Columbia, Oregon and Washington will take part in the exercises.

Random Lines

We Nominate Dr. Work for Dean of the College

Young men complain that the learned professions are overcrowded. We shall endeavor to earn their gratitude by suggesting to them a new avenue for their energies.

We believe there is a large field and rich rewards for the college graduate who will take up the profession of *political engineering*, which will lead to the universities conferring the degree of Bachelor and Master and result in qualified graduates only being retained as the advisers of political condidates. We must do in politics what we have done in architecture, mechanics, chemistry, all the various activities of life, to the advantage of all concerned. Our present methods are inefficient, wasteful, unscientific; we would put the business in the hands of experts, men trained in their profession, and save the candidates money and the people much trouble.—From the political correspondence column of the New York *World*, "The Looker on in Washington."

* * *

A New Batch

—Rose Brothers Co., *Wrecking Engineers*, Fort Humphreys, Va.

—*The Life Saving Engineer;* another name for the "safety engineer."

—*Motion Picture Engineer*—The Society of M. P. E. meets in convention in Ottawa.

—*Police Signaling Engineer*—A new highly specialized branch.

* * *

Concrete vs. Masonry; An International Analogy

From the speech of David Lloyd George, at Montreal.

"I have just come from your great neighbor. Their problem is a different one from ours. Their problem is to weld all those races into one common pattern. Their business is to do what you see those great machines do when they are making concrete—crush the rocks into the same size, the same pattern, weld it together by some substance that attaches and makes cohesion. There you have got to make the concrete, attach it by a common nationhood so as to make one solid nation of an infinite variety of types. That is the problem of the United States.

"Our problem is a problem of hewing rocks of granite or marble out of different quarries; of fashioning them, shaping them, putting them into the building—each separate block contributing its strength to the building, each contributing its color, its beauty, so that the whole will be a fabric of infinite strength and exquisite beauty—that is the British Empire."

Philadelphia Authorizes Huge Municipal Loan

People Will Vote November 6 on Bill Providing for Expenditure by City of $71,000,000

At a recent meeting of the Philadelphia City Council a municipal loan of $71,000,000 was approved to be submitted to vote of the people at the election on Nov. 6. The loan is provided in two bills, one for a loan of $3,000,000 to be made in 15-year bonds to cover short-life works, and the other for $68,000,000 to be made in 50-year bonds and to provide for works of permanent character. Items provided in the fifteen year loan are: Street and road paving and repairing, $2,400,000; extension of police signal system, etc., $440,000; refund of money appropriated from current funds for improvement to the Institution for the Feeble Minded, $160,000.

Chief among municipal improvements provided for by the 50-year loan are the construction of the first step in the recently approved high-speed transit system for the city, and the completion of the Delaware River Bridge. The complete list of items in the loan follows:

Completion of Delaware River Bridge	$5,623,000
Broad Street subway, with Ridge Avenue, Eighth, Walnut, and Chestnut St. subway, and Woodland Ave. elevated	15,000,000
Surface car subway in Chestnut St., connecting to Delaware River Bridge	10,000,000
Surface car line from Frankford "L" terminal	750,000
Harbor improvements	2,000,000
Sewage disposal plant	9,000,000
Water supply system	6,000,000
Street improvements	500,000
Free library buildings	1,000,000
Construction of sewers	3,300,000
Construction of city bridges	500,000
Construction of City Hall annex	2,000,000
High-pressure fire service extensions	200,000
Art museum construction	2,000,000
Street damages, etc.	5,077,000

The bills for these loans had been passed by City Council at a previous meeting and submitted for action of the Mayor. The Mayor returned them to Council unsigned, stating that he considered the provisions for city transit to be unduly favorable to the Philadelphia Rapid Transit Company, and that he did not approve of the provisions made for the City Hall Annex because another site is already owned by the city on which it had been contemplated to erect such a structure. The bills were repassed by City Council without action by the Mayor and were ordered to be submitted to vote of the people at the general election on November 6, 1923.

Sir Henry Maybury Invited to U. S. by Highway Officials

Sir Henry Maybury, the British road authority, has been invited by the American Association of State Highway Officials, the Highway Education Board, the American Road Builders' Association, and the Highway Research Council, to come to the United States to discuss plans for the proposed English-speaking road congress, which it is hoped to hold in the United States in 1926. Some of those who attended the Congress in Seville this year were convinced that more headway could be made at an assemblage of that character when a common language can be used.

Dean Cooley Resigns as Federation Head

Ill Health Cause—Executive Board Authorizes Action in Dismissal of Former Reclamation Head

Announcement of the resignation as president of the Federation of Dean Mortimer E. Cooley, authorization of a protest letter to be sent Secretary Work for his dismissal of A. P. Davis from the Reclamation Service, and reports and action upon licensing and government reorganization, were features of the session of the executive board of American Engineering Council of the Federated American Engineering Societies held at Rochester, N. Y., Oct. 11. Dean Cooley is retiring because of ill health. He has been granted a leave of absence from the University of Michigan for the second half of the 1923-1924 academic year. As his term as president of the Federation does not expire for another year it is probable that action will be taken whereby the beginning of the two-year tenure of the new president will begin in 1924, thereby making it unnecessary to select a president to fill the unexpired term.

Report on Davis Dismissal

Chief among committee reports was that of the Committee on Public Affairs, details of which outlined herein were authorized. It recommended that "a strong and dignified letter be addressed to Secretary Work commenting upon his letter of Aug. 14" which should bring out the following points:

1. That "an engineer and business man are not necessarily two distinct individuals, that a man with engineering training can be an excellent business man, and that, particularly in operations where engineering plays a large part, the executive or business man is more capable of filling the position if he has an engineering training."

2. That Secretary Work is "wrong in assuming that as soon as a project is finished, or supposed to be finished, its engineering aspect ends, and that then it is purely a business proposition." The letter should also state, the committee recommended, that reclamation is an ever continuing engineering matter.

3. That objection should be registered against the dismissal of any engineer or technical employee occupying "an important and responsible position" arbitrarily and "without a hearing at which charges may be brought against him and which he may have an opportunity of refuting."

In addition to this letter the committee recommended that a congressional investigation be made of the Davis-Davis matter and that it would probably be advisable for all constituent members of the Federation to acquaint members of congress in their respective communities with the underlying facts. The committee refrained from approving or disapproving the fact-finding commission which Secretary Work has appointed to get reclamation facts, inasmuch as members might have to appear as witnesses before the Work commission, or that the dismissal of Mr. Davis might not be considered at all by the commission.

In connection with the Davis matter, the Public Affairs Committee which had met a few days previous to its report in joint session with a special committee from the American Society of Civil Engineers, reported upon information given on reclamation and irrigation matters by Frank C. Wight, managing editor of *Engineering News-Record*, who explained the scope and broad content of the series of articles which this journal starts next week on reclamation.

The committee on Public Affairs also recommended that no action be taken at this time relative to the trial of so-called war-fraud contractors and engineers. Discussion of action on the Public Health Service led to the conclusion that it would be inadvisable to take action, owing to the strong belief among committee members that investigation of public health was not an engineering matter.

Department of Public Works

The Executive Board of the Council passed a resolution urging that the president of the Federation be authorized to appoint a special committee to "draft and have introduced into Congress a bill carrying into effect the portion of the reorganization plan" now before that body and prepared by the Joint Committee of the House and Senate. This action is in line with previous action on the part of certain engineering societies for the establishment of a national Department of Public Works, which should include all the engineering functions of the reorganized Department of the Interior, as contemplated in pending legislation. The Council, however, expressed regret at the delay in pushing the legislation, so put into resolution form its desire to consolidate engineering backing of a public works department.

The Publication Committee reported that wide publication had been secured in the public prints for the activities of the Federation, and that it was impossible to get advertising for the Federation's bulletin with its limited circulation.

Calvert Townley reported for the special committee on Revision of the Constitution that it was considering a simplification of the name by leaving out the word Federated, making it American Engineering Societies, and calling the American Engineering Council simply the Council of the American Engineering Societies. There was a lengthy discussion as to the possibility of considering affiliation of local societies at a reduced cost per capita through state representation at the January meeting of the Council, but it was finally decided that a more deliberate course would be preferable.

Licensing of Engineers

The report of the committee on Registration of Engineers occasioned a long debate. The model law drawn up by the committee, of which Gardner S. Williams is chairman, and submitted at the St. Paul meeting, is still being circulated for suggestion and comment. The mining and the chemical engineers object to any model law, urging that even if the expressed attitude of the F.A.E.S. is against registration the attempt to insure sanity and uniformity in states where it is inevitable by offering a law which is least objectionable will be misunderstood.

The next meeting of the Council of the Federation is set for Jan. 10 and 11 at Washington.

Recommends Safety Provisions in Federal Activities

That safety conditions in the federal service are behind the times was stated in a letter to President Coolidge made public by the Federated American Engineering Societies, the writer being M. G. Lloyd, chief of the Safety Section of the U. S. Bureau of Standards, and acting president of the American Society of Safety Engineers. The Executive Board of the Engineering Foundation, of which Mr. Lloyd is a member, has sanctioned a program for safety provisions in the activities of the government. Mr. Lloyd in calling attention to the recent disaster at the Bureau of Standards states that the American Society of Safety Engineers took cognizance two years ago of the lack of safety provisions and passed a resolution at that time. Also, a resolution was recently passed by the American Engineering Council of the Federated American Engineering Societies. Mr. Lloyd asks President Coolidge to include in his next message to Congress a recommendation for legislation which will establish in the federal departments adequate accident-prevention measures such as have been already recommended by the Congressional Joint Committee on Reclassification.

Engineers to Aid Seattle Chamber

The Seattle Chamber of Commerce has appointed a board of engineers to co-operate with and advise the industrial committee of the chamber, and compile information relative to the expansion of industry in the city. James E. Blackwell, city engineer of Seattle, is chairman of the board, and other members include: A. M. Young, structural engineer; E. L. Webber, consulting engineer; George Jamme, mining engineer; A. A. Miller, electrical engineer; A. L. Knisely, chemical engineer; and Joseph Jacobs, consulting engineer.

An important activity of the board will be to compile information relative to indutries for which Seattle offers particular advantages. Heretofore, this information has been compiled at intervals by specialists hired by the chamber, and such information, while satisfactory at the time, soon became out of date. The new board will be at the service of the committee to provide any character of industrial or engineering information required.

Iowa Water Works Men to Meet

The Iowa Section, American Water Works Association, will meet Oct. 21, 25 and 26 at Ames and Boone, Iowa. Nebraska, Missouri and South Dakota are included in this section. Fifteen papers, a round-table discussion, a joint session with the Ames Engineering Society and Ames Chamber of Commerce and an inspection of the water plants of Ames and Boone are scheduled. The papers will cover bacterial content, well water, geology of water supply, records, supervision, publicity, finance and fire insurance in addition to a description of four Iowa supplies. A sewage disposal conference of Iowa operators Oct. 22 and 23 will precede the water-works meeting.

St. Louis Zoning Ordinance Held Invalid by State Court

The Supreme Court of Missouri in a four-to-three decision handed down on Oct. 6 held that the St. Louis zoning ordinance is invalid on the ground that it is not an authorized exercise of the police powers granted the city by the state. The main opinion, written by Judge Robert F. Walker, was in the case of the Penrose Investment Co., which sued to compel James N. McKelvey, director of public safety, to issue a permit for the erection of an ice-making plant. Other suits included in the decision were brought by parties who had been refused permits for a junk shop and for an apartment house, the latter to face on Forest Park. If the city fails to get a re-hearing it will appeal the suit to the United States Supreme Court.

Engineering Societies

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; Fall Meeting, Richmond, Va., Oct. 17-20.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburg, Fla.; Annual Convention, Atlanta, Ga., Nov. 12-16.

CITY MANAGERS ASSOCIATION, Lawrence, Kansas; Annual Meeting, Washington, D. C., Nov. 13-15.

AMERICAN ROADBUILDERS' ASSOCIATION, New York City; Annual Convention, Chicago, Jan. 14-18.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich. Annual meeting (20th anniversary), Chicago, Ill., Feb. 25-28, 1924.

The California Section of the American Water Works Association will hold its fourth annual convention in Fresno, Oct. 25-27. Interesting features will be an automobile trip to the Kerckhoff dam and power house of the San Joaquin Light & Power Corp., and, on invitation of the Bureau of Sanitary Engineering of the State Board of Health, a visit of inspection to several sewage-disposal plants in the vicinity of Fresno.

The Engineers' Club of Trenton, N. J., at its meeting Oct. 11 enjoyed an illustrated talk on "The New York and New Jersey Vehicular Tunnel" by Colonel Frederick A. Snyder, assistant engineer of construction on the tunnel.

The Texas Section of the American Society of Civil Engineers recently held its fall meeting, electing officers as follows: President, H. A. McKenzie, of the McKenzie Construction Co., San Antonio; vice-presidents: John A. Morris, State Board of Water Engineers, Austin, and J. C. McVea, city engineer, Houston; and secretary-treasurer, E. N. Noyes, Myers & Noyes, construction engineers, Dallas.

Harvard Engineering Society, Undergraduate Section, was addressed Oct. 13 by **Frank C. Wight,** managing editor of *Engineering News-Record*, on "The Imperfect Art of Engineering."

The Iowa Section of the American Water Works Association will have its annual meeting Oct. 24-26 at Ames and Boone, Iowa, with meetings at Iowa State College at Ames and inspection of the water works at the two towns. Members of other state sections will be made welcome.

The Colorado Scientific Society had as a recent speaker D. W. Brunton, chairman of the board of consulting engineers for the Moffat tunnel, who spoke on the problems contemplated or likely to arise in the boring of the tunnel. He also pointed out that when the Moffat tunnel is completed, if the Denver & Rio Grande Western R.R. will build the "Dotsero cutoff," about 42 miles of track, the distance from Denver to Salt Lake can be shortened by 174 miles.

Personal Notes

L. F. SCOTT, who is now assistant highway engineer with the U. S. bureau of public roads with headquarters at Chicago, was formerly division engineer with the Kansas Highway Commission at Fort Scott, Kan.

D. D. MICKEY has resigned as resident engineer of federal-aid projects in Linn County, Kan., and has entered the employ of the U. S. Bureau of public roads with headquarters at Omaha, Neb.

A. V. MILLAR, professor of engineering at the University of Wisconsin, Madison, has been appointed assistant dean of the college of engineering, University of Wisconsin.

EINAR G. ALMQUIST, lieutenant of the Royal Corps of Engineers of Sweden, is making a tour of the United States with a view to gaining practical experience about engineering construction in this country, particularly with reference to road and bridge construction. He has spent several weeks in Philadelphia working as carpenter's helper on the construction of the anchorages of the Delaware River Bridge.

W. A. MACLEAN, deputy minister of highways for Ontario, has resigned and is succeeded by S. L. SQUIRE, who has been prominent in connection with the good roads movement.

LLOYD ALDRICH, who had charge of the concrete test highway at Pittsburg, Calif., has opened an office as consulting highway engineer in Los Angeles.

HORNADAY CONSTRUCTION CO., municipal contractors and engineers, Memphis, Tenn., announce a local change of address from 1261 Central Ave. to 388 Shrine Bldg., Memphis.

R. H. HOWARD, chief engineer of maintenance-of-way, Wabash R.R., has been appointed chief engineer, succeeding A. O. Cunningham, appointed consulting engineer. The two former positions have been consolidated.

M. F. LONGWILL and J. J. BAXTER, division engineers of the Wabash R.R., have been appointed assistant chief engineers in charge of the eastern and western districts respectively.

S. W. FREESE, associated with John B. Hawley, Ft. Worth, Tex., a hydraulic engineer, has been given a year's leave of absence to take a master's degree in engineering at Trinity College, Cambridge University, England. Mr. Freese is a graduate in civil engineering from Massachusetts Institute of Technology and had previously attended Southern Methodist University at Dallas.

GEORGE O. BUTLER, C. A. BARNETT, and ALEX O. TAYLOR have formed a partnership, known as Butler, Barnett & Taylor, in West Palm Beach, Fla., for the practice of engineering. All three were recently on the W. J. Conners Highway as chief engineer and division engineers, respectively.

W. F. HUPP, Massena, N. Y., formerly assistant superintendent on highway construction for the Shepherd Construction Co., has accepted a similar position with the Henry P. Burgard Co., Buffalo, N. Y.

LEWIS BERRY, Herington, Kan., has severed his connection with the Moreno-Burkham Construction Co. of St. Louis to become filtration plant superintendent with Burt & Tripp Construction Co.

H. S. ANDREWS, formerly bridge designer for the Long Island R.R. and residing at Jamaica, N. Y., has been appointed commissioner of public works at Fulton, N. Y.

G. F. HATCH, formerly assistant engineer of the city of Portland, Maine, has been made assistant engineer of the Pitometer Co., New York City, for work on water-waste surveys.

Obituary

HAROLD W. YOUNG, 36 years of age, assistant engineer on the Southern Pacific R.R. Natron cutoff project near Klamath Falls, Ore., came in from the project Oct. 9 and later was found dead in a hotel in Klamath Falls, shot through the head, with every indication of suicide.

J. H. PATTON, assistant division engineer of the Union Pacific R.R., with headquarters at Salt Lake City, Utah, was killed Oct. 11 near Medicine Bow, Wyo. With a companion he was riding on a "speeder" making an inspection. A freight train caught them, crushing the car, killing Mr. Patton and seriously injuring G. R. McDougal, his assistant. Mr. Patton was 24 years of age.

RALPH PETERS, president of the Long Island R.R. since 1905, died suddenly of heart disease Oct. 9 at his home at Garden City, L. I. On Nov. 19 he would have reached his 70th birthday and retired. Mr. Peters was born in Atlanta, Ga., a son of Richard Peters, pioneer railroad builder, and was a graduate of the University of Georgia, class of 1872.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Japan Places Large Orders for American Lumber

At least a full month earlier than had been expected by Northwest lumbermen, Japan has placed initial orders for 80,000,000 ft. of North Pacific Coast lumber for reconstruction purposes. The order is largely for squares and "baby" squares, indicating that Japanese saw mills are not all out of commission. A quantity of the order was for lumber of ordinary mill stock sizes which, until next April, can be sent into Japan duty free under an emergency tariff suspension rule. The effect of the Japanese orders will undoubtedly be to strengthen a market already strong and to stimulate production by the mills. Labor supply is reported adequate for the increasing demands and at present there is no log shortage.

Report of the Pacific Northwest Lumber Inspection Bureau for the first six months of 1923 shows that cargo shipments of lumber from Pacific Northwest ports have exceeded those of the same period of 1922 by more than 11 per cent and have set a new record.

Electrical Equipment Orders for Japan Exceed $1,000,000

The Westinghouse Electric International Co. has received orders for electrical apparatus to be used in reconstruction work in Japan totaling well over $1,000,000. Other orders are in course of negotiation which will bring the total amount to approximately $2,000,000. It is understood that the power plants in the quake zone were not seriously damaged but that the distribution systems were practically destroyed.

Portland Cement Association Sends Investigator to Japan

Homer M. Hadley, district engineer in charge of the Seattle office of the Portland Cement Association, sailed Oct. 5 for Japan to investigate results of the earthquake on Sept. 1 upon modern structures, particularly those consisting largely of reinforced concrete. Mr. Hadley will probably be absent three months at least, although it is expected he will be able to cable a condensed preliminary report soon after his arrival.

Mr. Hadley's structural experience was gained with a number of the foremost Pacific Coast engineering firms.

American Motor Trucks Shipped to Aid Japanese Restoration

Shortly after wire communications had been established, following the Japanese earthquake, cabled instructions were received in this country for the shipment of American motor trucks. The first consignment of Pierce-Arrow machines has already been made and a second shipment is about to leave.

Asphalt Simplification Effective Jan. 1

Commerce Department Announces Endorsement of 10 Varieties by Consumers and Producers to Reduce Waste

After January 1, 1924, "Too many asphalt grades" no longer will be the complaint of public highway officials, engineers, contractors, and producers, the Department of Commerce having announced that upon that date the recommendations adopted at its recent asphalt paving conference will become effective and asphalt grades for use in the construction of sheet asphalt, asphaltic concrete, asphalt macadam, and surface-treated pavements will be reduced from 88 to 9. The number of asphalt grades used as joint filler in the construction of brick and block pavements and various other types has likewise been reduced from 14 to 4 [of which 3 are included in the foregoing 9 grades for roads and streets, bringing the total of approved grades for all paving purposes to 10].

(I) For construction of Sheet Asphalt, Asphaltic Concrete, and Asphalt Macadam Pavements, and also for Surface Treatment.

Penetration Limits		
25 to 30	50 to 60	100 to 120
30 to 40	60 to 70	120 to 150
40 to 50	85 to 100	150 to 200

(II) For Joint Filler for Various Types of Construction.

Penetration Limits	
30 — 50	60 — 70
50 — 60	85 — 100

The first is used primarily for brick pavements, and does not require the admixture of sand, whereas the latter three which are identical with three of the grades adopted for asphalt pavement construction, are those which would ordinarily be used in admixture with sand to produce an asphalt grout.

(III) In adopting these limits, it is understood that the producer will furnish asphalts with penetration equal to the mid-point in each range, a plus and minus tolerance from that mid-point being acceptable to all parties, but in no case shall the deviation exceed the limits of the grade specified.

A complete report of the conference at which the reduction in the number of asphalt varieties was adopted is in process of printing and will be published about Dec. 1 by the Department of Commerce as one of its series on "Elimination of Waste in Industry." It will be entitled "Simplified Practice Recommendation No. 4—Asphalt" and can be obtained from the Superintendent of Documents, Government Printing Office at Washington at 5c. per copy.

The endless multiplicity and nonuniformity of specifications having reached a point which demanded nationwide co-operative action on the part of engineers, contractors and producers, at the suggestion of Secretary Hoover a systematic approach to a solution was made during the spring and summer by all parties interested and a constructive reduction of varieties was effected.

Nine definite penetration limits for the construction of sheet asphalt, asphaltic concrete, asphaltic macadam pavements and for surface treatment, and four penetration limits for joint filler for various other types of construction, including brick and granite block pavements, were unanimously adopted at a general conference held at the Department of Commerce on May 28, 1923, and have been officially accepted as the standard of practice by the highway engineers of 30 states, the American Society for Testing Materials, the Society for Municipal Improvements, the American Society of Civil Engineers, the United States Bureau of Public Roads, the Asphalt Association, and 5 manufacturers not members of the Asphalt Association. It was the sense of the conferees that the recommendations should become effective on all deliveries of material after Jan. 1, 1924, and that they should be subject thereafter to annual review and such revision as the industry may desire.

The accompanying table gives the penetration limits as adopted.

Committees Named for Road Show and Convention at Chicago

Chairmen of committees for the Good Roads Show and convention of the American Road Builders' Association, to be held in Chicago, Jan. 14-19, have been named as follows:

PUBLICITY, S. T. Henry, Allied Machinery Co. of America, New York; RECEPTION AND HOTEL, G. W. Craig, Asphalt Association, Chicago; REGISTRATION, L. S. Louer, *Engineering & Contracting*, Chicago; PROGRAM, C. S. Hill, *Engineering News-Record*, New York; ENTERTAINMENT, A. Cronkrite, Universal Portland Cement Co., Chicago; BANQUET, J. F. McGurk, Camden Petroleum Co., Chicago.

All of these committees will report to the convention and show manager, Charles M. Upham, State Highway Engineer, Raleigh, N. C.

Production of Lumber, Lath and Shingles: 1922 and 1921

The Department of Commerce announces that the total production of lumber during 1922 in the United States was 31,426,922,000 ft., an increase of 16.5 per cent when compared with the cut reported for 1921, but a decrease of 9 per cent compared with the cut for 1919.

The production of lath was reported as 2,905,595,000 in 1922 and 1,970,696,000 in 1921, and the production of shingles 8,068,585,000 in 1922 and 6,843,187,000 in 1921.

Comparing the statistics for 1922 with those for 1921 the greatest changes are shown for the western states, the states in that region apparently having recovered from the severe depression of 1921.

In 1922 yellow pine contributed 36.6 per cent of the total cut for all kinds of wood, Douglas fir 21.4 per cent, and western yellow pine 6.6 per cent.

The figures for 1921 and 1922 are not strictly comparable. In 1922 the output of mills cutting under 50 M ft. each was omitted and in 1921 the cut of custom mills was omitted. The cut of neither class, however, materially affected the totals.

Advertisers Urged to Use Complete Street Address

Advertisers in newspapers and magazines are causing a great deal of trouble to the United States Post Office by failing to use a complete street address in their printed matter. In the larger cities particularly the manufacturer's name followed by the name of the town and state is not always sufficient identification for the rapid distribution of mail. Postmaster E. M. Morgan, of New York City, has just sent out a statement calling upon advertisers to help the Post Office Department by using street addresses in all of their printed literature and other advertising. In New York, according to Mr. Morgan, 80,000 pieces of mail, exclusive of those addressed to the largest and best known firms, are received at the New York post office every day without street address. The delivery of the bulk of this mail is delayed from 8 to 24 hr. and every day 10,000 pieces of mail remain undelivered for want of a complete address.

Postmaster Morgan says in part: "If advertisers do not include in their advertisements the complete address that will insure delivery of mail sent as the result of such advertisements, not only will the burden of disposing of this mail continue but the advertiser will lose the business which he is seeking by reason of delay or non-delivery of the replies."

Name Members of Japan's Reconstruction Board

The Metropolitan Reconstruction Board in Japan, which is to have charge of all reconstruction work throughout the devastated area, has been enlarged and will consist of eleven members, according to a cablegram to the U. S. Department of Commerce from the commercial attache at Tokyo. K. Inaba, formerly chief of the Engineering Bureau of Hokkaido, has been named chief of the Land Adjustment Bureau in place of S. Miyao who was originally selected for that post. E. Ota, formerly counsellor for the government railways, has been designated chief of the Engineering Bureau in place of R. Naoki, who will serve as chief engineer. The office of executive secretary has been assigned to K. Kanai.

Business Notes

CAL CHEMICAL CO., INC., Hagerstown, Md., manufacturer of concrete accelerator and curing compound, announces the recent opening of sales offices and warehouse facilities in Chicago and New York. The Chicago office is in charge of A. S. Harrison, who is also vice-president and Chicago manager of the Minwax Co. The New York office is in charge of M. F. Cavallon, formerly New York representative of the A. T. Malmed Co. and the Hy-Test Cement Co.

GIBB INSTRUMENT CO., Bay City, Mich., manufacturer of electric welding equipment, announces the appointment of H. A. Wilson as manager of its Detroit branch, in place of F. M. Luchs, resigned. Mr. Wilson was formerly district manager in New York for A. P. Munning & Co.

Last Call for Exhibit Space at Good Roads Show

Applications for space at the Road Show to be held by the American Road Builders' Association in the Coliseum, Chicago, Jan. 14-18, 1924, are being received in even greater volume than was the case a year ago. Allotment of space will be made Nov. 1, and prospective exhibitors who wish their applications to be considered must have them in the hands of Charles M. Upham, the association's convention and show manager, not later than Oct. 27. The application blanks were sent out some time ago, but additional blanks may be obtained by writing to Mr. Upham, care of American Road Builders' Association, Raleigh, N. C.

The meeting in Chicago on Nov. 1, at which exhibit space will be allotted, will be confined to the members of the executive committee of the American Road Builders' Association, the executive committee and representatives of the Highway Industries Exhibitors' Association and the advisory committee of the Exhibitors' Committee. On account of the large number of applications and the limited space available, it has been found necessary to restrict the attendance at this meeting to the committees named above.

Equipment and Materials

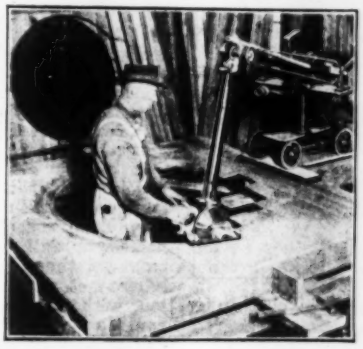
Large Tackle Blocks Hand Made

For handling 68-ton plate girders on the new Straus building in Chicago, described in *Engineering News-Record* of Sept. 27, p. 523, exceptionally large tackle blocks were supplied to the contractors, the Thompson-Starrett Co., by the W. W. Patterson Co. of Pittsburgh, for use on two large guy derricks. There were two five-sheave blocks and six six-sheave blocks, which are shown in the accompanying illustration. The former weighed 628 lb each and the latter 720 lb. each.

These blocks were hand-made throughout. They had shackles forged from solid 5 x 5-in. billets hammered down to 3 in. round and bolts 2 in. in diameter. The diameter of the sheave pins was 2 in. The straps were 5 x ⅞ in. and all plates were ⅞ in. thick. The edges of the plates were ground and filed to prevent cutting of the cable. The sheaves were 16 in. in diameter and were grooved for ¾-in. cable.

Portable Wood Working Machine Cuts Cost of Forms

To reduce the cost of labor in making wooden forms for concreting and for other forms of millwork, including sawing, mortising, drilling and planing, the P. L. Billingsley Co., 425 Elm St., Cincinnati, Ohio, has developed the portable, electrically operated woodworking machine illustrated in the accompanying photograph. The machine, called the Flexway, is mounted on a four-wheel carriage with roller bearings and the swivel post is carried on ball bearings. The sawing head is adjustable to cut any angle up to 55 deg., a feature adapting it particularly to the cutting of jack rafters, in addition to joists, studding, bridging, siding and



flooring. In the cutting of circular holes for column head forms a radius rod, adjustable to different size circles, guides the tool around a perfect circumference.

Five of these machines are now in use by the Ferro-Concrete Construction Co., Cincinnati, Ohio, whose president, W. P. Anderson, makes the following comments on the operation of the equipment:

"One of the great advantages of the machine is that it is portable and can easily be taken to any job where electric current is available or moved around to any point on the job. The illustration herewith shows the machine in use for cutting a round hole for a column cap; with it one man can cut five holes where only one could be cut by hand.

"The other principal use we make of the machine is in cutting panels and this can be done on the bench where panels are made. The machine cuts, measures and squares the ends of the form, and is so flexible and evenly balanced that only one motion of the arm is necessary to get either square or beveled ends. This enables us to increase our output 25 to 30 per cent with the same amount of labor as was formerly used when the panel had to be cut by hand. In fact, the form ends

can be cut off in less time than it formerly took to mark the lines for handsawing. The use of this machine with our company is confined principally to form-making but I believe it will effect a greater saving to house-builders than it does to us, as it could practically do all millwork in house construction."

Compact Air Motor Hoist for 500-Lb. Loads

For lifting and handling loads up to 500 lb. in repair or assembly shops the Ingersoll-Rand Co., New York, has placed upon the market a new air motor hoist for loads too heavy for one man. This hoist operates on air pressures from 60 to 100 lb., has a lifting speed of 50 ft. per minute, a maximum lift of 15 ft., uses ¼-in. wire rope and weighs 150 lb.

A feature of this equipment is an automatic brake which holds the load even if the air supply be disconnected or fail. A balanced three-cylinder motor operates in either direction, without vibration, and is geared through a mechanical train to the hoisting drum. A graduated throttle permits close regulation of both lifting and lowering speeds. Motor and gears are inclosed, the former operating in a bath of oil and the latter in heavy grease. In place of the top hook shown in the accompanying illustration a roller-bearing, monorail trolley can be supplied.

Publications from the Construction Industry

Truck-Mounted Crane—BYERS MACHINE Co., Ravenna, Ohio, illustrates a variety of uses of its Truckrane in a 16-p. pamphlet. The crane, which can be mounted on the chassis of any 5-ton motor truck, has a 25-ft. latticed steel boom designed to handle a ½-yd. clamshell bucket. Among the operations on which the use of the mobile crane is shown are the handling of batch boxes from truck to paver on road work, transferring sand or crushed stone from railway cars to trucks, stock piling sand, excavating in a gravel pit, unloading coal cars, earth excavation for building foundations.

Concrete Mixers—JAEGER MACHINE Co., Columbus, Ohio, has published a 48-p. illustrated booklet on its tilting-drum type of concrete mixer with capacities of 3, 4, 7, and 14 cu.ft. Most of the mixers illustrated are equipped with power loaders and a new tip-over water tank. A feature of the mixer equipment is the company's new vibrating distributor in the form of a chute which is subjected to a jarring movement in order to distribute semi-dry mixed concrete which would not otherwise flow down to the trough from the discharge end of the mixer. A portion of the text is devoted to the Jaeger concrete placing plant which includes an inclined track, skip, hopper and chutes.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Japan Will Require Three Billion Feet of Lumber

Output Is Equal To Demand Provided Japanese Will Accept Ordinary Building Sizes and Grades

The Douglas Fir Exploitation and Export Co. will send a commission to Japan early in November. The object of the mission according to the National Lumber Manufacturers' Association is "to provide technical assistance in rebuilding the devastated region and to encourage the Japanese to modify the sizes and specifications of lumber which they have required for their use, so that a large proportion of the products of the American logs can be utilized in meeting the needs of Japan.

"It is estimated that it will require over a thousand shiploads of three million feet each to rebuild the devastated areas, and America is the only country that can quickly respond and whose output is equal to such a demand."

The Japanese trade, according to the Association, formerly called for squares, ranging in size from 4 x 4 in. (10 to 20 ft. lengths) to 24 x 24 in. (24 to 40 ft. lengths) all in merchantable grade.

The combined resources of British Columbia, Washington and Oregon cannot furnish over a billion ft. of these sizes and grades in a year, says a prominent lumberman of the West Coast, and if the demand is as great as estimated, lower grades and sizes must be used.

"The large squares," states the report, "especially must be produced from the cream of the log, leaving a large proportion of side lumber not suitable for the demands of the Japanese. This is not in the interest of conservation, nor is it in accordance with the standardization program. If the Japanese will use ordinary building sizes of lumber they can secure more lumber at lower price, and this will tend to prevent a more or less acute situation in the domestic market."

Reports to the U. S. Department of Commerce place the destruction of buildings at 316,000 in Tokio and 70,000 in Yokohama. At the time of the disaster, large reserve stocks of lumber were stored in Kobe, Osaka, Tokio and other cities. With the destruction of stocks in Yokohama and Tokio, there would still be a fairly good supply left in the other cities for immediate emergency purposes. The real demand, according to the lumber manufacturers, will come when the permanent construction of the devastated areas commences.

Advices received from the Consulate General of Japan at New York, and made public by the U. S. Department of Commerce, state that by an Imperial ordinance, building materials and necessities of life will be exempted from import duty until March 31, 1924.

Next week—Essential data on fifty large contracts awarded since March—Total value $157,460,646.

5,967 contracts reported by Engineering News-Record

for seven months, Mar. 1 to Oct. 1

14	at	$5,000,000
174	at	1,000,000
184	at	500,000
310	at	200,000
2,044	at	100,000
341	at	50,000
2,771	at	25,000
129	at	10,000
5,967	averaging	$220,000

Total Value:

$1,324,642,000

Foreign Projects of Interest to Americans

A number of foreign construction projects which should be of interest to American engineers, contractors and manufacturers has just been reported by the United States Department of Commerce. They are merely noted here, further information being available at the Bureau of Foreign and Domestic Commerce or its district of co-operative offices, when a reference number is given.

A Spanish city, through its governing council, has appropriated $1,500,000 for the construction of low-price houses. The appropriation is for subsidizing concessionaires in order to relieve the housing shortage among the laboring classes. Subsidies of from $30,000 to $300,000, representing 30 per cent of the total estimated cost of the houses, have been granted to six companies.

Plans have been approved by the Minister of Public Works for a pontoon bridge to connect two **Danish** cities. The cost is estimated at $2,412,000, at present exchange. Reference No. 35x-1.

A Lithuanian city has approved plans for a water and sewerage system to cost $2,000,000, and it is proposed to grant a concession to some foreign construction company. Reference No. 106,546.

In a city in India extensive hydro-electric plans are underway. One of the projects is a dam 190 ft. high and more than a mile in length. It is stated that this dam will exceed the Assuan dam by 3,000,000 cu.ft. of masonry.

The Indian Stores Department is calling for bids on equipment for two large hydro-electric projects. Reference No. 106,908.

Bids Wanted on Chinese Bridge

The Hai Ho Conservancy Commission, Tientsen, North China, will receive tenders until May 1, 1924, for the construction of a bascule or other type of opening bridge over the Hai Ho River. The new bridge will be 306 ft. long, with a 40 ft. roadway with 9 ft. sidewalks on either side. The moveable span is to be of such design that when the bridge is opened the fairway will be 140 ft. The estimated cost is $550,000. Specifications are filed with the Bureau of Foreign and Domestic Commerce.

Many More Projects This Year Than Last

Reports published in Construction News in the first half of 1923 numbered 2,263 more than in the first half of 1922 for the United States alone. This is an increase of 16 per cent. Detailed figures are given in two tables on p. 207 of last week's Construction News.

Every section of the country reflects this greater activity, with the exception of the South. Southern projects totaled 1,763 in the first six months of 1923, against 1,787 last year. On the other hand the 412 contracts awarded there this year averaged $230,000, whereas last year's 411 awards averaged $219,000.

In the entire United States the 4,362 awards reported by *Engineering News-Record* aggregated $1,047,230,000, an average of $240,000. In the same period last year the 3,895 contracts totaled $779,767,000, an average of $200,000.

Minimum costs of these projects are as follows: Water-works, $15,000; other public works, $25,000; industrial construction, $40,000; commercial buildings, $150,000.

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 215 to 226, are the following:

Subway, Brooklyn, N. Y., to T. A. Gillespie, New York City, $1,725,884.

(*Continued on p.* 662)

Building Equipment Required for News-Record Contracts

For the $868,529,000 worth of industrial and building contracts noted in *Engineering News-Record* from Jan. 1 to Oct. 1, plumbing, heating and lighting equipment, paint and elevators to the value of $118,000,000 has been or will be purchased. This year's large contracts for industrial expansion have exceeded $200,000,000. Commercial building awards amounting to $150,000 or larger, aggregate $667,136,000. The money value of the painting and equipment required for both the industrial works and the large building contracts published in Construction News during the last nine months is estimated as follows:

	Industrial Works	Buildings
Plumbing	$1,040,000	$13,340,000
Heating	7,200,000	33,350,000
Lighting	5,540,000	23,345,000
Elevators	1,000,000	13,340,000
Painting	6,320,000	13,340,000
	$21,100,000	$96,715,000

Bids wanted on big water-works job at Denver, Colo., by Board of Water Commissioners. Work involves 96 tons of special castings. Total value, $327,000. B. Lowther, engineer.

Car Loadings Break All Records

Freight loadings for the week ended Sept. 29, totaled 1,097,274 cars, the greatest number for any one week in the history of American railroads. This exceeds by 4,707 cars, the previous record which was established for the week of Sept. 1, when the total was 1,092,567 cars. Seasonal crop and coal movements are responsible for the increase.

Public Bond Sales Dull During Last Three Months

The month of September did not show any more activity in the sale of state and municipal bonds than the months of July and August. The *Commercial and Financial Chronicle* reports the total of long term bonds for September to be $50,216,404 against $51,345,526 for last month and $99,776,656 for September a year ago. The largest issues of the last month were the $5,000,000 North Carolina, 5½ per cent, 2-yr. notes; the several bonds of the City of Buffalo, N. Y., totaling $3,510,000 at 4½ per cent; and the waterworks bonds of Cleveland, O., for $3,360,000 at 4¾ per cent.

During September $11,102,000 United States municipal bonds were offered without success.

Of the 40 representative bond issues included in the accompanying table, six were sold at par, three below and the remainder above. The yields ranged from 4 to 5.99 and the rate of interest from 4 to 6 per cent.

REPRESENTATIVE BOND SALES DURING SEPTEMBER

State	Purpose	Amount	Rate Per Cent	Sold For	Basis	Dated	Maturity	Purchased By
North Dakota	Real Estate	$1,000,000	5½	105	5	Apr. 1, 1923	Due serially	Wells-Dickey Co., Stacy & Brown
Rhode Island	Penal & Charitable Inst. Loan	50,000	4	100	4	Sept. 1, 1923	Sept. 1, 1973	Natl. Exch. Bank, Providence
County								
Akron School Dist., Ohio	School	1,000,000	5½	101.97	5.03	Oct. 1, 1923	1924–1944	W. A. Harriman & Co., New York
Bedford School Dist., Ohio	School	74,192	5½	100.02	5.49	Sept. 1, 1923	1924–1931	Seasongood & Mayer, Cincinnati
Live Oak Drainage Dist., La.	Drainage	75,000	5½	100	5	Apr. 1, 1923	Apr. 1, 1925 due serially	Canal-Commercial Trust & Savings Bank, New Orleans
Essex, N. J.	Sewer	117,000	5	103.11	4.76	Oct. 1, 1923	1924–1962	J. S. Rippel & Co., Newark, N. J.
Duval, Fla.	Roads	1,050,000	5	98.28	5.15	July 1, 1923	1928–1953	Stacy & Brown & A. B. Leach & Co., Inc., New York and others
Duval, Fla.	Bridges	450,000	5	98.28	5.15	July 1, 1923	1928–1953	Sidney Spitzer & Co., Toledo, O., and others.
Shoshone, Ida.	Highway	160,000 140,000	5½	100.001	5.24	July 1, 1923	1933–1942	Union Trust Co., Spokane
Black Hawk, Ia.	Roads	150,000	5	100	5	Sept. 10, 1923	.....	White-Phillips Co., Davenport, Ia.
Webb, Tex.	Roads	250,000	5½	101.53	5.36	Oct. 10, 1923	1924–1953	Ryan, Bowan & Co., Toledo, O.
Kenosha, Wis.	Courthouse and Jail	500,000	5	101.415	4.83	Oct. 1, 1923	1924–1943	R. M. Grant & Co., Kenosha
Stanislaus, Calif.	Irrigation	135,000	5	100.0007	4.99	Oct. 1, 1923	1934–1953	First Natl. Bank, Modesto
Orange, Ind.	Roads	33,000	5	100.34	4.92	Oct. 1, 1923	1924–1933	Paoli State Bank, Paoli, Ind.
East Chicago, Ind.	School	200,000	5	102.025	4.84	Sept. 1, 1923	Sept. 1, 1943	Fletcher Savings & Trust Co., Indianapolis
Gary, Ind.	School	346,000	5	100.06	4.98	Oct. 1, 1923	Oct. 1, 1943	C. W. McNear & Co., Chicago
Long Island Drainage Dist., La.	Drainage	225,000	5½	100	5½	Apr. 1, 1923	1925–1950	Canal-Commercial Trust & Savings Bank, New Orleans
Municipality								
Fredonia, N. Y.	Street Improvement	90,000	4½	100.01	4.74	Oct. 1, 1933	1924–1933	Citizens Trust Co., Fredonia
Goshen, Ind.	Water, heat, light and power	50,000	5	100.11	4.98	Sept. 26, 1923	1925–1934	Union Trust Co., Indianapolis
Greece, N. Y.	Lake Shore Water Dist.	180,000	4.8	100.11	4.78	Oct. 1, 1923	1926–1943	Sherwood & Merrifield, New York
Leavenworth, Kan.	City Hall	250,000	5	101.35	4.933	Oct. 1, 1923	1934–1953	Branch-Middlekauf Co., Wichita, Kan.
Louisville, Ky.	Sewer	952,000	4½	100.59	4.45	Oct. 3, 1923	Feb. 1, 1960	Eldredge & Co., New York and others
Menominee, Mich.	Waterworks	50,000	5	101.91	4.87	Oct. 1, 1923	1947–1950	Harris, Small & Co., Detroit
Moorhead, Minn.	Paving	50,000	5½	101.50	5.172	July 1, 1923	1925–1945	Minnesota Loan & Trust Co., Minneapolis.
Nanticoke, Pa.	Borough	130,000	5	101.72	4.64	Sept. 15, 1923	1924–1930	M. M. Freeman & Co., Philadelphia
New Orleans, La.	Belt R. R.	600,000	5	100	5	Sept. 24, 1923	.....	Hibernia Securities Co., New Orleans and others
Rome, N. Y.	Paving	45,515	6	100.08	5.99	Oct. 1, 1923	1924–1927	Sherwood & Merrifield, New York
Jamestown, N. Y.	Bridge	22,000	4.6	100.08	4.58	Oct. 1, 1923	1924–1933	Sherwood & Merrifield, New York
North Providence, R. I.	School	100,000	4½	99.805	4.77	Nov. 1, 1923	Annual	R. M. Grant & Co., Boston
Schenectady, N. Y.	Public Improvements	280,000	4½	100.51	4.42	Sept. 1, 1923	1924–1933	.....
	Sewer	120,000	4½	100.51	4.42	Sept. 1, 1923	1924–1943	G. B. Gibbons & Co., New York
Tekamah, Neb.	Paving	40,000	5	100	5	Sept. 15, 1923	Sept. 15, 1933	State of Nebraska
Terre Haute, Ind.	Fire Alarm System	104,000	5	101.67	4.74	July 1, 1923	1924–1939	Harris Trust & Savings Bank, Chicago
Newark, N. J.	Sewer	1,000,000	4½	100	4½	Oct. 1, 1923	1924–1963	Ironbound Trust Co., Newark
	Water	500,000	4½	100.072	4.49	Oct. 1, 1923	1924–1963	West Side Trust Co., Newark
	Improvements	500,000	4½	100.072	4.49	Oct. 1, 1923	1924–1963	Wide Side Trust Co., Newark
	Public Buildings	100,000	4½	100.013	4.49	Oct. 1, 1923	1924–1963	Clinton Trust Co., Newark
	Street Cleaning	100,000	4½	100.412	4.36	Oct. 1, 1923	1924–1928	Natl. State Bank, Newark
	School	1,099,000	4½	100.03	4.49	Oct. 1, 1923	1925–1958	Clinton Trust Co., Newark
Township								
Noble School Twp., Ind.	School	30,000	5	100.88	4.85	Oct 1, 1923	1925–1936	Mier State Bank, Ligonier

Large Contracts Let During Week

(*Continued from p. 661*)

Power Station, Kearny, N. J., to Public Service Production Corporation, Newark, about $20,000,000.

Offices, Los Angeles, Calif., to P. J. Walker Co., San Francisco, $1,350,000.

Hospital, Nashville, Tenn., to Hegeman-Harris Co., New York City, $2,000,000.

Factory, Ottawa, Ill., to Jobst & Son, Peoria, over $5,000,000.

Lock, Illinois, to Green & Sons Co., Chicago, $1,460,012.

Hotel, Chicago, Ill., to Paschen Bros., $2,250,000.

Lock, Pittsburgh, Pa., to Dravo Contracting Co., $738,590.

Disposal Plants, Pittsford and Brighton, N. Y., to P. H. Murray, Rochester, $223,936.

Sewerage System, Brighton, N. Y., to Oakwood Constr. Co., Detroit, Mich., $393,467.

Sanitary Sewers, Pittsford, N. Y., to Rauber and Vicinus, Rochester, $131,690.

Conduit, Portland, Ore., to Willamette Iron & Steel Works, $2,571,404.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the the issue of Oct. 4; the next, on Nov. 1.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$3.64	$4.00	$4.20	$3.40	$3.55	$4.20	$3.60	$4.10	$4.00
Structural rivets, 100 lb.	4.40	4.75	4.90	3.75	4.25	5.30	5.00	—4.25	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.54	3.50	+4.00	3.20	3.45	3.85	3.65	4.10	3.90
Steel pipe, black, 2½ to 6 in. lap, discount	44%	53%	43%	47%	53–5%	36%	33.2@42.2%	35%	47.42
Cast-iron pipe, 6 in. and over, ton	63.60	—54.00	63.00	60.20	60.50	69.00	62.00	62.00	60.00
Concreting Material:									
Cement without bags, bbl.	2.70@2.80	2.60	2.05	2.20	2.50	2.84	2.63	2.90	2.25
Gravel, ¾ in., cu.yd.	1.75	—1.85	2.38	2.00	1.85	1.90	2.15	1.25	1.50
Sand, cu.yd.	1.25	1.24	2.00	2.00	1.25	1.00	1.50	1.25	1.25
Crushed stone, ¾ in., cu.yd.	1.75	2.00	2.83	2.00	2.00	3.50	2.15	3.00	1.90
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	62.00	39.00	52.25	58.50	44.75@45.75	48.00	41.00	29.50	70.00
Lime, finishing, hydrated, ton	18.20	25.00	20.00	20.00	25.50	24.00	22.00	24.00	21.00
Lime common, lump, per bbl.	3.00@3.25	1.60	1.75	1.50	1.50	2.70	2.10	2.80	—9.50
Common brick, delivered, 1,000	—22.40@23.65	11.00	11.60	11.00	17@19	12.00	15.00	15.00	16.50
Hollow building tile, 4x12x12, per block	Not used	.102	.115	.0724	.0816	.065	.....	.11	.115
Hollow partition tile 4x12x12, per block	.1179	.102	.115	.....	.....	.065	.108	.11	.....
Linseed oil, raw, 5 bbl. lots, gal.	.98	1.00	—1.08	1.14	1.02	1.12	+1.07	.86	—1.38
Common Labor:									
Common labor, union, hour	.75	.35	.....	.....	.....	.50@.55	.55	.....	.....
Common labor, non-union, hour	....	.30	.30@.50	.82½	.50@.55	.35@.50	.50	.56¼@.62½	—.30

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent. Charge is 15c. per 100 lb. for cutting reinforced steel into 2-ft. lengths or over.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93¾c.; building laborers (pick and shovel men) 75c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in iron bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 98.64). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3-in., $47.42; 6-in., $119.

Changes Since Last Week

Although a certain amount of stimulation is noticeable in the current market, most buyers are limiting purchases to actual requirements. The fact that domestic buying is confined to small lots and that the Japanese demand has not yet exerted its full effect upon materials resources, few changes, either up or down, are noticeable in the price tables.

Seattle reports a drop of 50c. per 100 lb. in structural rivets and Dallas, an advance of 5c. in reinforcing bars, due to scarcity of local stocks. Cast-iron pipe dropped $1 per ton and ¾-in. gravel, 5c. per cu.yd. in Atlanta.

Concreting materials and lumber remain firm, with few exceptions, throughout the entire country.

Common brick are quoted at $19@$20 per M., wholesale, alongside dock, New York, against $20, one week ago. The fluctuation is due mainly to heavy brick reserves being stored in the Hudson River district and to importations of considerable quantities of foreign brick. Extensive demolition of old buildings in New York, is throwing large quantities of second-hand brick upon the market, which have been quoted as low as $14 per thousand.

While San Francisco reports an advance of 3c. per gal. in linseed oil, the recent downward trend has not yet abated as evidenced by declines of 1c. and 2c. per gal., reported in Dallas and Montreal, respectively.

The iron and steel situation may be briefly outlined as follows: Pig-iron sales dropped to half of usual volume. Consumers purchasing on basis of month to month requirements. Japan will need about 60,000 tons of galvanized steel sheets. Japanese buying on strictly competitive basis, hence, several large steel orders placed in Germany. Steel plates firm at $2.50 per 100 lb., Pittsburgh, with reports of shading to $2.40. Structural market quiet but with no evidence of weakness; quotations holding firmly at $2.50. Bars firm at $2.40 base. Rest of steel list firm with exception of shading in black sheets and decline in scrap.